Bedford Institute of Oceanography Net and Environmental Sensing System (BIONESS) Construction Details

D.D. Sameoto, L.O. Jaroszynski, and W.B. Fraser

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B2Y 4A2

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Fisheries and Marine Service

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by

D.D. Sameoto, L.O. Jaroszynski and W.B. Fraser,

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Ocean and Aquatic Sciences

Marine Ecology Laboratory

Dartmouth, Nova Scotia

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ABSTRACT

Sameoto, D.D., L.O. Jaroszynski and W.B. Fraser. 1979. Bedford Institute of Oceanography Net and Environmental Sensing System (BIONESS) Construction Details. Fish. Mar. Serv. Tech. Rept. 903: 47 p.

Complete construction details, drawings for the BIONESS frame, and a description of the electronic controls are presented. The sampler's performance is briefly described.

SOMMAIRE

Sameoto, D.D., L.O. Jaroszynski and W.B. Fraser. 1979. Bedford Institute of Oceanography Net and Environmental Sensing System (BIONESS) Construction Details. Fish. Mar. Serv. Tech. Rept. 903: 47 p.

On présente les détails de la construction complète, les dessins du charpente de la BIONESS (Système de filets multiples et de détection de l'environnement de l'Institut Océanographique de Bedford), et une courte description des contrôles électroniques. Aussi, on discute brievement la performance de l'échantillonneur.

INTRODUCTION

A need existed for a pelagic sampling net that was capable of collecting simultaneously a wide size range of animals from small zooplankton in the 300 µm size class to micronekton several centimetres in size. The prerequisites for such a sampler were (1) it be capable of filtering large volumes of water during each sample (2) it be towed at speeds between 3 and 5 knots to reduce the sampling time needed to filter large volumes of water and (3) designed to reduce animal avoidance of sampler. The large sample volumes were needed to obtain adequate numbers of the larger animals which usually have a low density per cubic metre (i.e. small squid whose density may only be one per 500 to 1000 m^{-3}). The collected animals had to be in good condition for accurate identification and measurements. The sampler had to be able to collect a number of samples during each tow in order to study the vertical and horizontal distribution of the animals. It was important that the sampler be capable of carrying a variety of environmental sensors if the relationship between the animals and their environment was to be understood. The samplers that came closest to these requirements were the multiple net samplers recently described by Wiebe et al. (1976) and Sameoto et al. (1977).

It was our purpose to make a multiple net sampler more compact and streamlined than the above-mentioned models in order to reduce its front profile and make it less visible to reduce the sampler avoidance as well as fulfill the necessary prerequisites discussed above. The physical size of the sampler and therefore the maximum size of the nets was determined by launching and retrieving capabilities of the ships on which the sampler was going to be used. This resulted in a maximum net mouth size of 1 m^2 (Fig. 1); but had the handling facilities been larger the sampler could have been any size.

The following report is a detailed description of the mechanical construction of the sampler with a brief description of the electronic controls and sensors. The handling and preformance of the sampler is also discussed.

MECHANICAL CONSTRUCTION

The sampler frame resembles an open ended steel box 146 cm high, 146 cm wide, and 74 cm deep (Fig. 1 and 2). A system of 10 nets is attached to 10 horizontal bars stacked one behind the other. This arrangement is shown in Fig. 3a where net number 1 is seen in the open position. It also shows the attachment of the nets to the horizontal bars. The lower lip of the net is attached to the bar in front of the net and the upper lip attached to the horizontal bar behind the first bar. Therefore as a horizontal bar is released (i.e. No. 1 in Fig. 3a) the previous net is closed as the next net behind it is opened. Each horizontal bar is lead-filled to increase its weight (21 kg) and facilitate a more rapid closing of the net as the bar descends between two vertical runners (called guide rods in the drawings). Between the horizontal bars and the vertical runners is an arrangement of teflon wheels and pads to reduce friction on the runner.

The nets are attached to the horizontal bars by steel plates bolted to the front of the horizontal bars (Fig. 3b). A loop in the collar of each net extends above the steel plate into which is inserted a steel rod that prevents the net from being pulled out from under the plate.

A complete set of engineering drawings are provided in Fig. 4 to 17 with a list of all the materials needed for the frame construction given in Table 1. Figure 2 demonstrates the sampler as it looks being towed through the water with one of the nets open. The other nets are not shown in the Figure for simplicity's sake.

For a complete discussion of the net operation see Sameoto et al. (1979).

ELECTRONIC CONTROLS OF THE SAMPLER

A detailed discussion of the electronic sensors and controls of the sampler are beyond the scope of this report. But schematic diagrams of the underwater and on-deck electronics are given in Fig. 18 and 19 as well as a photograph of the on deck microprocessor and display unit(Fig. 20).

Three signals are required by the sampler (1) to operate the stepping motor which activates the release mechanism, (2) to reset the net counter, and (3) to trigger the camera. The three signals are tone coded on the positive supply line and are decoded by phase locked loop detection at the underwater unit.

The output voltages from the various sensors are fed to a 16-channel analog multiplexer. Each channel is applied sequentially

to a 15-bit analog-to-digital converter (A/D). The output of the A/D, the multiplexer channel number, and a parity bit are transferred into a shift register and transmitted up the cable in a serial mode. A clock pulse and a channel 1 synchronizing pulse are also transmitted.

The surface electronics are controlled by the microcomputer system consisting of an Intel 80/10 one-board computer with I/O and memory expansion boards, and is interrupt-driven in real-time.

The sensors mounted on the sampler frame were two flow meters, one to measure flow through the net and one for flow outside of the net, a conductivity cell, temperature probe, pitch, roll and yaw indicators, depth sensor, and light meter. Additional instruments that could be added at will were a camera and strobe light, *in situ* fluorometer and oxygen probe.

The flow meters were modified T.S.K. flowmeters which give two contact closures per revolution. The contact closures are counted by a binary counter and applied to a digital-to-analog converter which produces a proportional D.C. voltage.

The salinity sensor had a specified accuracy of $\pm$0.01 ppt and resolution of $\pm$0.001 ppt over a typical operation range of 28 to 40 ppt. The temperature sensor had a range of -2°C to +30°C, an accuracy of $\pm$0.01°C, and a resolution of $\pm$0.003°C.

The depth sensor was a Viatran strain gauge pressure transducer with an accuracy of $\pm$0.25% full scale, an a resolution of 0.05% full scale. The yaw sensor consisted of a vane magnetically coupled to a potentiometer inside a watertight case and had an accuracy of $\pm$1°C.

The pitch and roll indicators were pendulum pots gimballed and mounted at right angles and have accuracies of $\pm$1°.

SAMPLER PERFORMANCE

Underwater video observations were made of the BIONESS at speeds from 1.5 to 4.5 knots using a television camera mounted in the mouth of the sampler. It was seen that at speeds below 3 knots the sides of the net behaved like bellows that were opening and partially closing. This may have been due to the upward flow from the depressor hitting the ends of the nets combined with low water pressure in the tails of the nets as a result of there being more material than was needed to filter all of the water entering the net at slow speeds. At speeds between 3 and 4 knots the nets were stable as they were almost completely filled out by the water pressure. The filtering efficiency of the net (243 µm mesh) between 2 and 4 knots was constant at 95% of the flow outside the net.

When all the nets were closed at speeds of 2 knots or less there was a great deal of whipping of the cod-ends observed on video. The whipping action was greatly reduced at speeds of 3 knots. The reduction of whipping and billowing suggested that there may be less damage to animals in the net at the higher speed than at 2 knots or less. The condition of the animals in the samples after a tow of over one hour at 3 knots was excellent with a large majority of the zooplankton and fish still alive when removed from the plankton buckets.

The sampler was very effective in capturing a large size range of animals in a 243 µm mesh net. The animals ranged from copepods of about 300 µm to pelagic fish and micronekton several centimetres in length. A typical zooplankton and micronekton catch is given in Table 2 which shows the numbers m^{-3} and the size range of the animals (Table 3).

Sameoto *et al.* (in press) gives a more complete description of handling of the sampler at sea.

ACKNOWLEDGEMENTS

We would like to express our appreciation to Mr. G. Steeves and his staff in the Systems Engineering Group for the design and construction of the deck control unit, and to Mr. D. Reimer of the Marine Ecology Laboratory and Mr. W. Hall of the Metrology Group of the Bedford Institute of Oceanography for their able assistance in the construction and testing of the sampler.

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Sameoto, D.D., L.O. Jaroszynski and W.B. Fraser (in press). The BIONESS, a new design in multiple net zooplankton samplers. J. Fish. Res. Board Can.

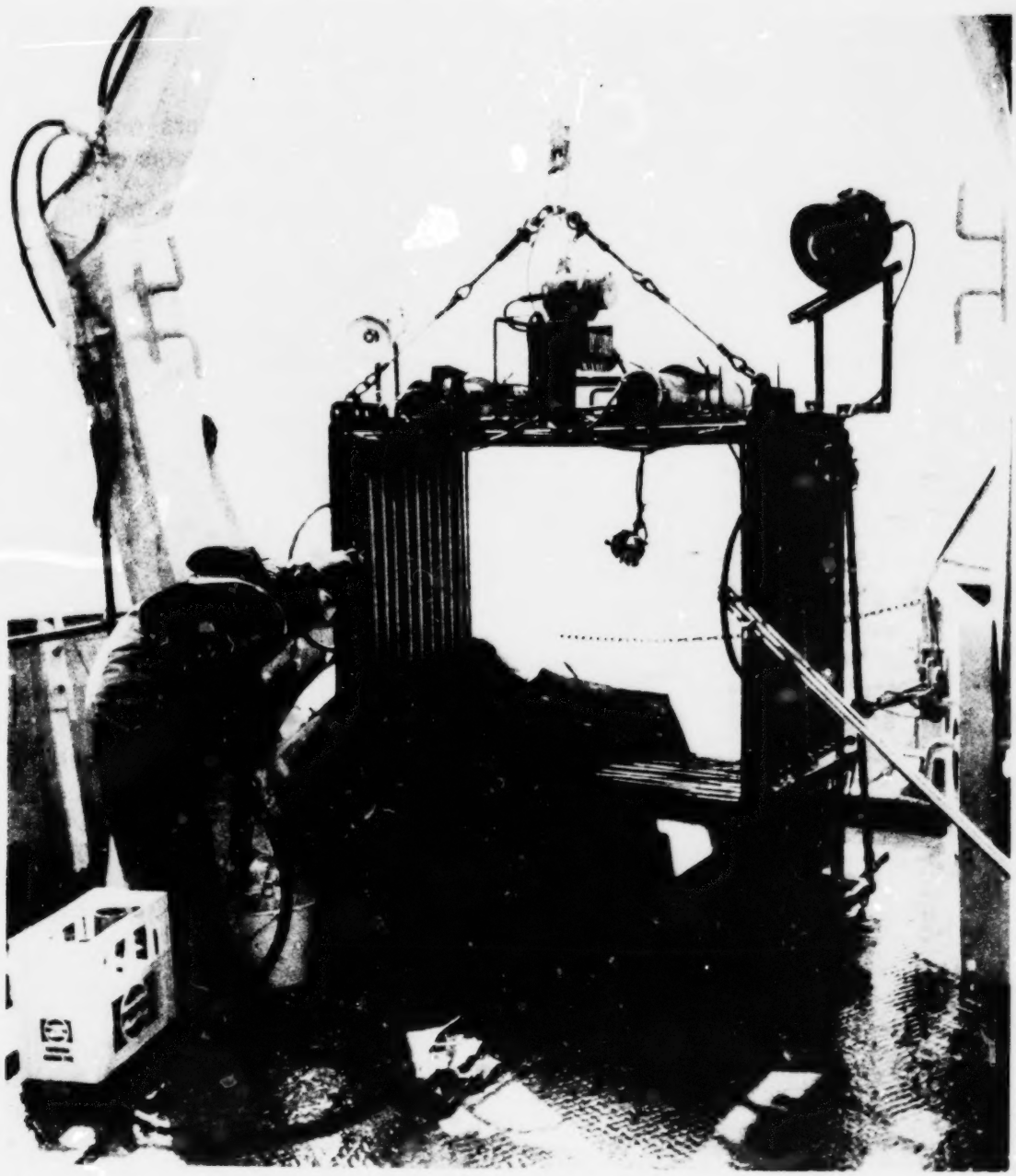


Fig. 1 BIONESS on deck with samples being removed.

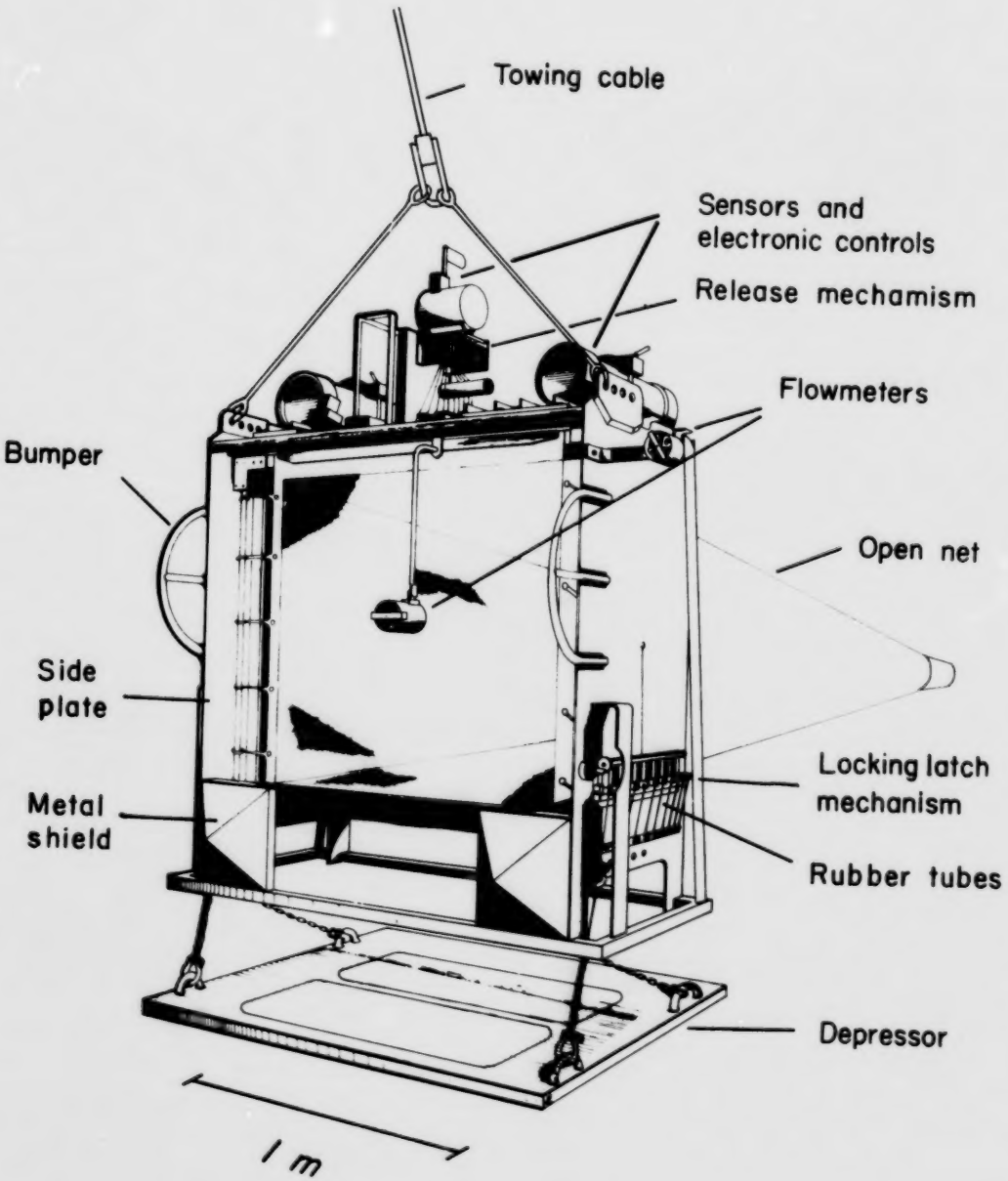
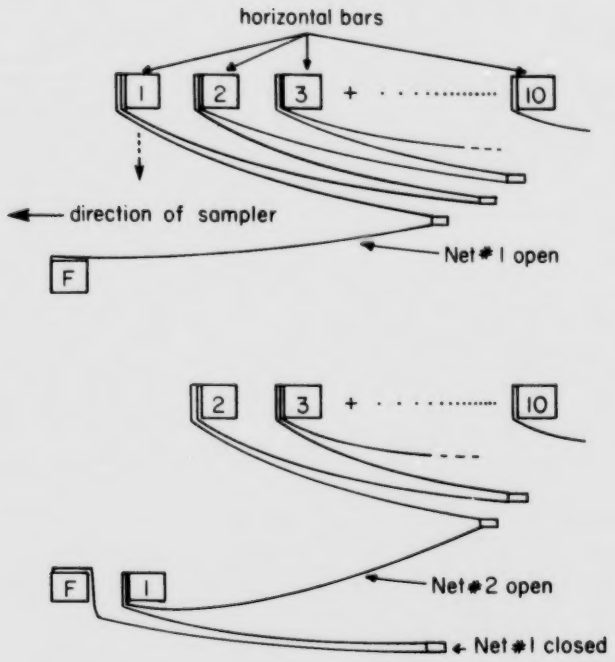
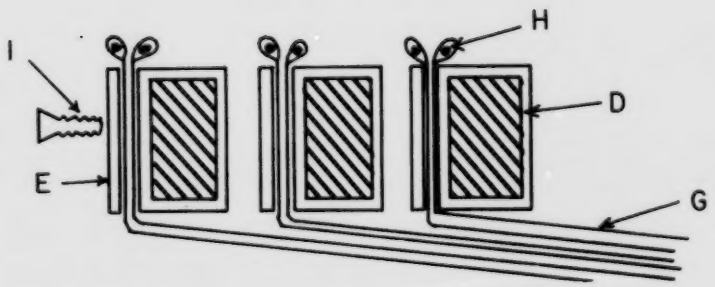


Fig. 2 View of sampler as it would appear being towed through the water.



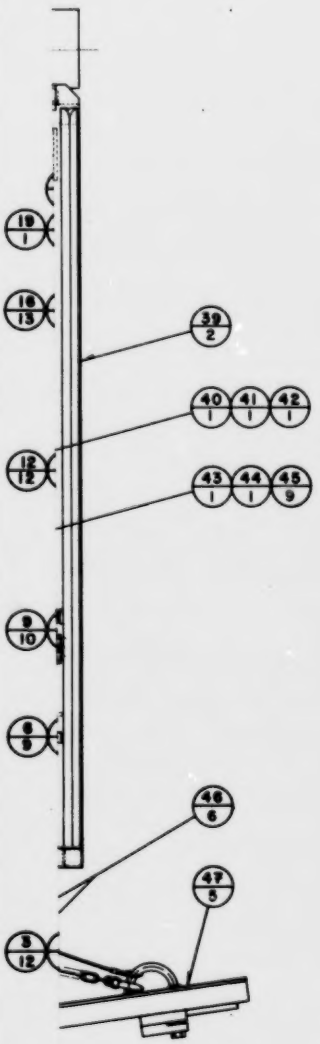
(a)



(b)

Fig. 3 Diagramatic representation of the arrangement of the horizontal net bars and net attachment to these bars.

Fig. 4 Front and side view of the general assembly of the frame and depressor.



ITEM	QTY	SHT	DESCRIPTION
49	4		SS. M6-0.75 x 12 lg. BOLTS C/W SS LCK WRS.
48	1		SENSOR
47	1		DRAG PLATE S/ASSY.
46	2		SHACKEL-CHAIN S/ASSY.
45	1		MICRO-S/W CAM S/ASSY.
44	4		SS. M8-1.25 NUTS.
43	4		SS. 8.2 d FLAT WRS.
42	1		MICRO-S/W S/ASSY.
41	3		SS. PAN HD. M/C SCRS M4-0.5 x 30 lg
40	3		SS. M4-0.5 NUTS C/W SS. LCK. WRS.
39	1		MAIN FRAME WELDMENT
38	1		FLOW METER
37	3		SS. M4-0.5 x 12 lg FLAT HD SCRS
36	3		SS. M4-0.5 NUTS. C/W SS LCK WRS.
35	1		SS. M8-1.0 x 24 lg BOLT.
34	1		SS M8-1.0 NUT C/W SS LCK WRS.
33	1		ELECTRONICS POD NO. 1
32	1		" " " 2
31	1		FLOW METER SLIDE S/ASSY.
30	4		SS. M8-0.75 x 44 lg BOLT.
29	4		SS. 8.2 d FLAT WRS.
28	1		NET SLIDE TRIGGER S/ASSY.
27	8		SS. M8-0.75 x 24 lg BOLTS.
26	8		SS M8-0.75 NUTS. C/W SS LCK WRS.
25	2		SS HOSE CLAMPS 180-200 d
24	1		ELECTRONICS POD NO. 3
23	6		CLAMP NUTS.
22	3		CLAMPS.
21	1		ELECTRONICS POD NO. 4
20	10		NET SLIDE S/ASSY.
19	50		SS. M8-0.75 x 18 lg BOLTS.
18	20		SS. M8-0.75 x 70 lg FHD SCRS C/W SS NUTS.
17	20		SS. M8-1.0 x 70 lg. " " " " "
16	1		SLIDING FLOW METER S/ASSY.
15	1		SS. M8-1.0 x 30 lg BOLT.
14	1		SS. M8-1.0 NUT C/W SS. LCK. WRS.
13	10		NET S/ASSY.
12	1		NET CLAMP S/ASSY.
11	4		SS. M8-0.75 x 24 lg. BOLT.
10	4		SS. 8.2 d FLAT WRS.
9	2		NET SLIDE GUIDE ROD S/ASSY.
8	16		SS. M10-1.0 x 24 lg. BOLTS.
7	16		SS. M10-1.0 NUTS. C/W. LCK. WRS.
6	2		CAM FINGER S/ASSY.
5	8		SS. M6-0.75 x 40 lg. BOLTS.
4	8		SS. M6-0.75 NUTS C/W. LCK. WRS.
3	2		COVER WELDMENTS.
2	12		SS. M6-0.75 x 18 lg. BOLTS.
1	8		SS. M6-0.75 NUTS. C/W. LCK. WRS.

MATERIALS LIST

BEDFORD INSTITUTE OF OCEANOGRAPHY
DARTMOUTH ——— NOVA SCOTIA

TITLE
RESEARCH EQUIPMENT B.I.O. NET & ENVIRONMENT SENSING SYSTEM.
GENERAL ASSEMBLY

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DATE 27/JULY/76

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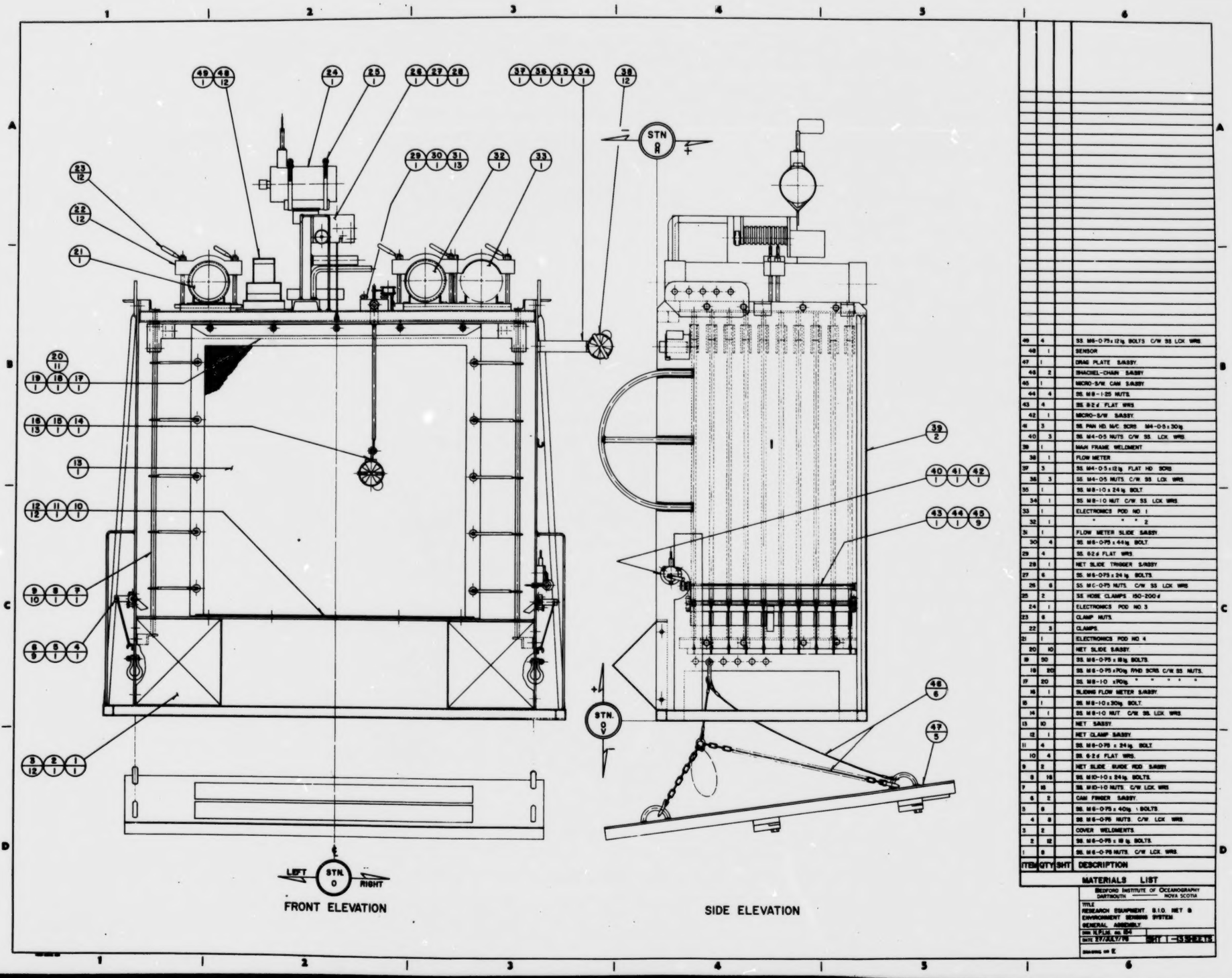

ITEM	QTY	SHT	DESCRIPTION
49	4		SS M6-0.75x12lg BOLTS C/W SS LCK WSHR
48	1		SENSOR
47	1		DRAG PLATE S/ASSY
46	2		SHACKEL-CHAIN S/ASSY
45	1		MICRO-S/W CAM S/ASSY
44	4		SS M8-1.25 NUTS
43	4		SS 8.2 d FLAT WSHR
42	1		MICRO-S/W S/ASSY
41	3		SS PAN HD M/C SCRS M4-0.8x30lg
40	3		SS M4-0.5 NUTS C/W SS LCK WSHR
39	1		MAIN FRAME WELDMENT
38	1		FLOW METER
37	3		SS M4-0.5x12lg FLAT HD SCRS
36	3		SS M4-0.5 NUTS C/W SS LCK WSHR
35	1		SS M8-1.0 x 24 lg BOLT
34	1		SS M8-1.0 NUT C/W SS LCK WSHR
33	1		ELECTRONICS POD NO 1
32	1		" " " 2
31	1		FLOW METER SLIDE S/ASSY
30	4		SS M8-0.75 x 44 lg BOLT
29	4		SS 8.2 d FLAT WSHR
28	1		NET SLIDE TRIGGER S/ASSY
27	6		SS M6-0.75 x 24 lg BOLTS
26	6		SS M6-0.75 NUTS C/W SS LCK WSHR
25	2		SS HOSE CLAMPS 150-200 d
24	1		ELECTRONICS POD NO 3
23	6		CLAMP NUTS
22	3		CLAMPS
21	1		ELECTRONICS POD NO 4
20	10		NET SLIDE S/ASSY
19	20		SS M6-0.75 x 18 lg BOLTS
18	20		SS M6-0.75 x 70 lg PAN HD SCRS C/W SS NUTS
17	20		SS M8-1.0 x 70 lg " " " " "
16	1		SLIDING FLOW METER S/ASSY
15	1		SS M8-1.0 x 30 lg BOLT
14	1		SS M8-1.0 NUT C/W SS LCK WSHR
13	10		NET S/ASSY
12	1		NET CLAMP S/ASSY
11	4		SS M8-0.75 x 24 lg BOLT
10	4		SS 8.2 d FLAT WSHR
9	2		NET SLIDE GUIDE ROD S/ASSY
8	16		SS M10-1.0 x 24 lg BOLTS
7	16		SS M10-1.0 NUTS C/W LCK WSHR
6	2		CAM FINGER S/ASSY
5	8		SS M6-0.75 x 40 lg " BOLTS
4	8		SS M6-0.75 NUTS C/W LCK WSHR
3	2		COVER WELDMENTS
2	12		SS M6-0.75 x 18 lg BOLTS
1	8		SS M6-0.75 NUTS C/W LCK WSHR

MATERIALS LIST

BEDFORD INSTITUTE OF OCEANOGRAPHY
DARTMOUTH — NOVA SCOTIA

TITLE
RESEARCH EQUIPMENT B.I.O. NET & ENVIRONMENT SENSING SYSTEM
GENERAL ASSEMBLY

DWN. R.PLUE ck. BH
DATE 27/JULY/76
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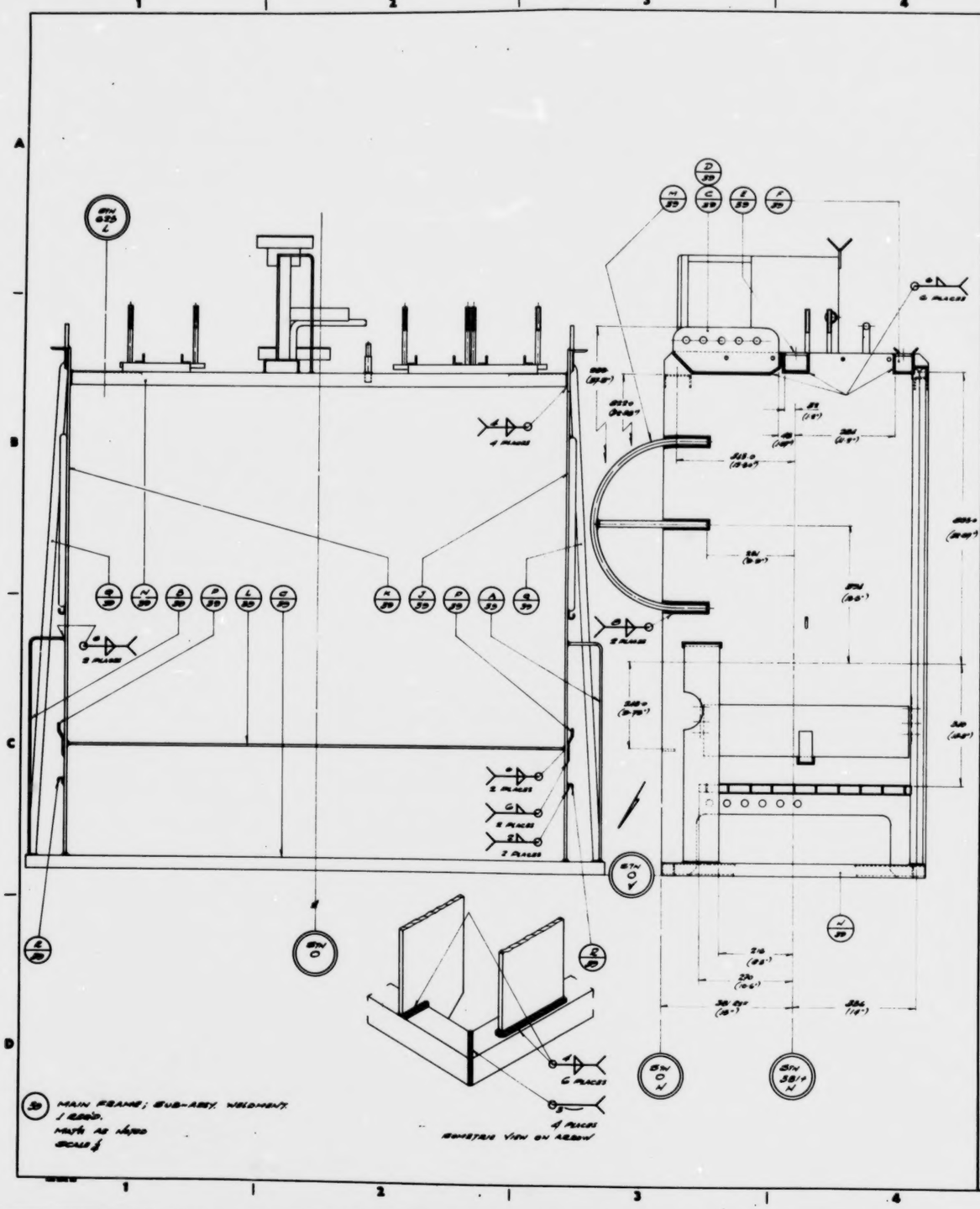
Fig. 5 Main frame. Subassembly, support bracket, rear bracket and hook.



MAIN FRAME; SUB-ASSY. WELDMENT
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4 PLACES
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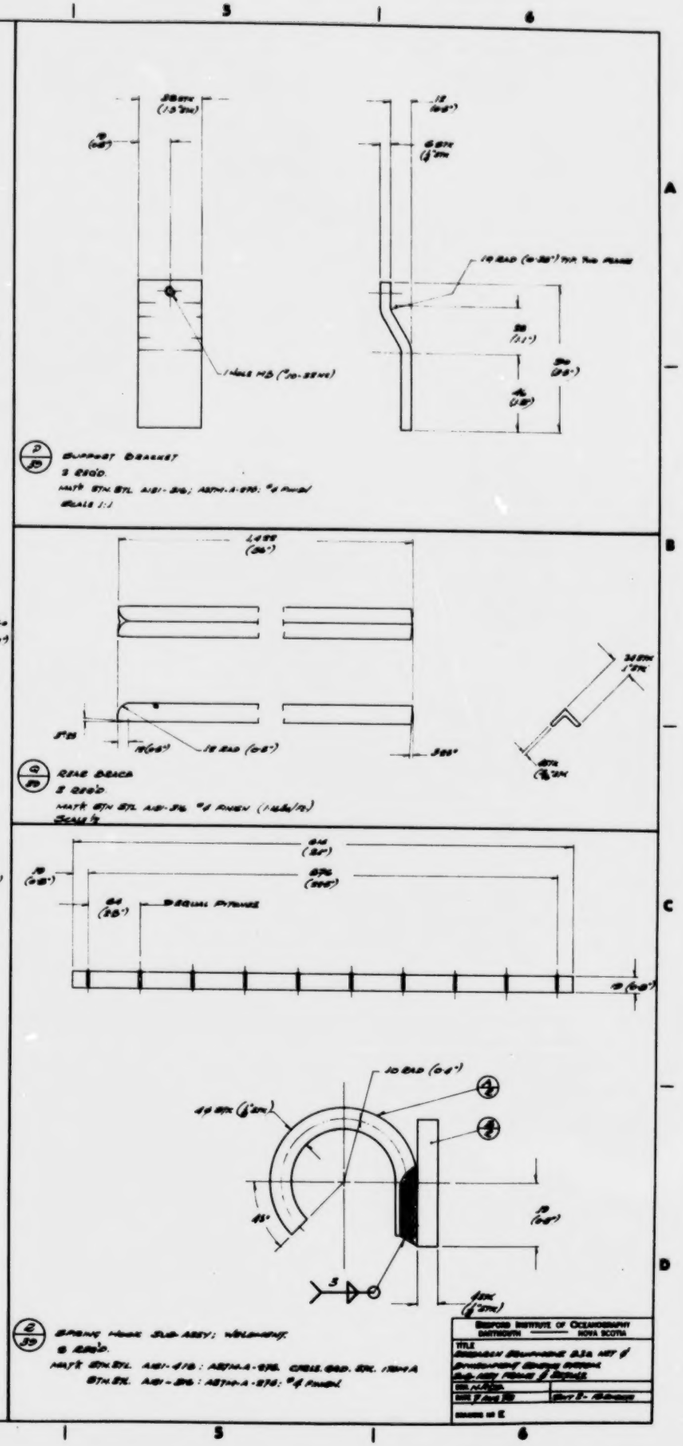

SUPPORT, BRACKET
2 REQ'D.
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SCALE BRACK
2 REQ'D
MATL'S STN STL A181-316 #4 FINISH (14GA/2)
SCALE 1/4

STRONG HOUSE SUB-ASSY; WELDMENT
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MATL'S STN STL A181-410 : ASTM-A-276 CRES. GRD. STL. TYPE A
STN STL A181-316 : ASTM-A-276 : #4 FINISH

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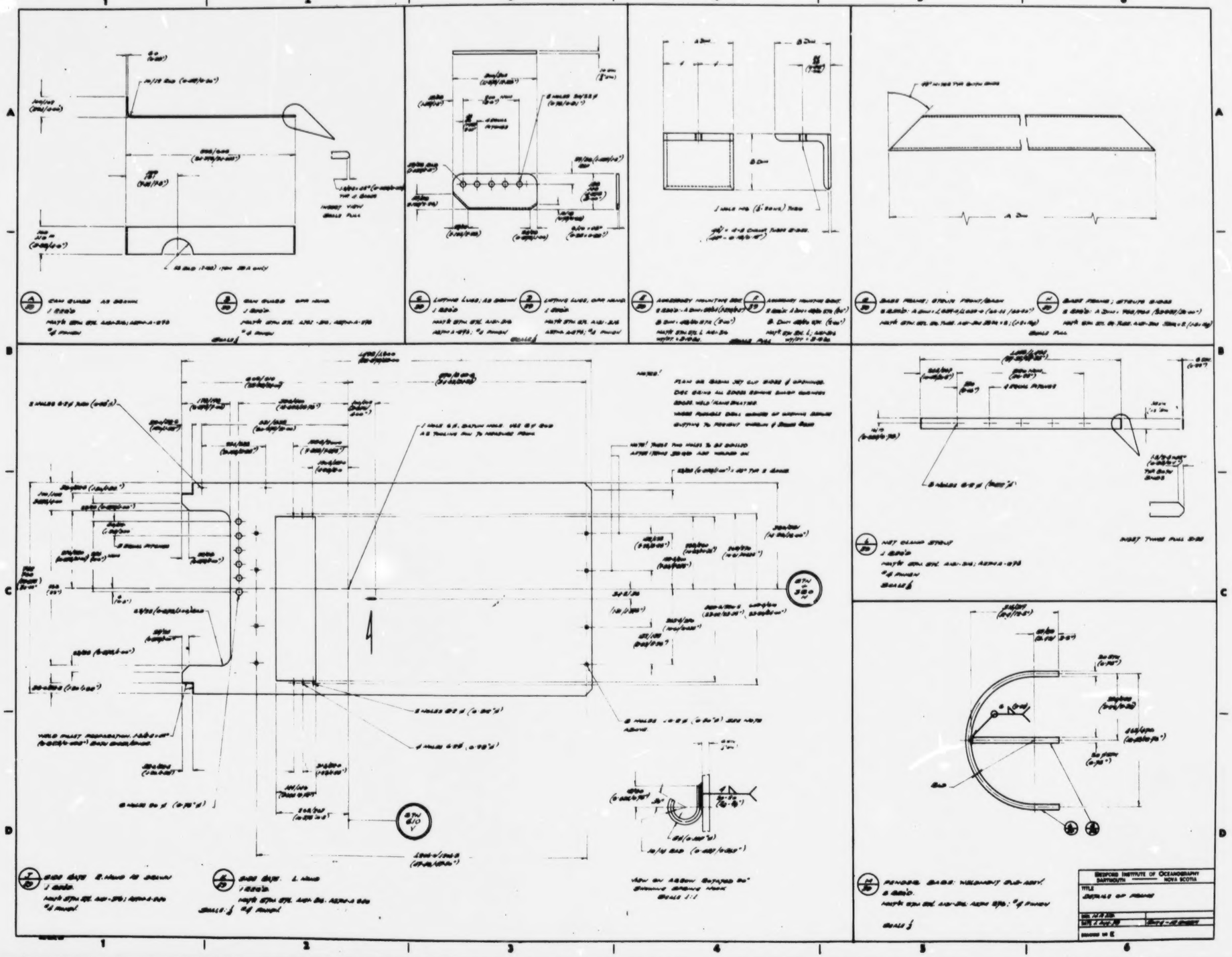
Fig. 6 Cam guard, lifting lug, accessory mounting bracket, base frame, side plate, net clamp strut, fender bars.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DARTMOUTH NOVA SCOTIA
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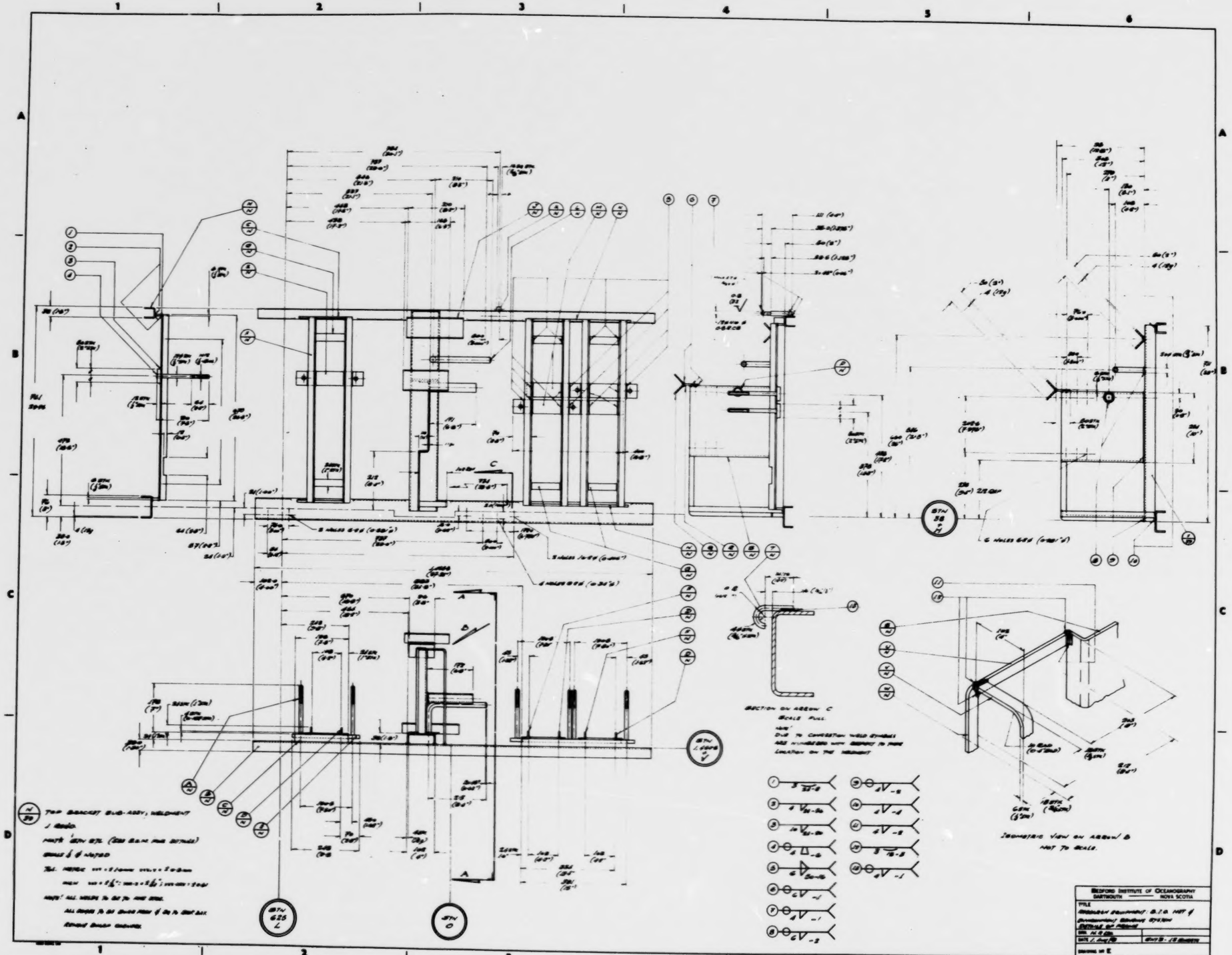
DETAILS OF FRAME

Fig. 7 Top bracket of frame.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ISOMETRIC VIEW ON ARROW B
NOT TO SCALE.
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DARTMOUTH — NOVA SCOTIA

Fig. 8 Net clamp, flow meter bracket, cover, sensor housing, pressure case clamp, and clamp nuts.

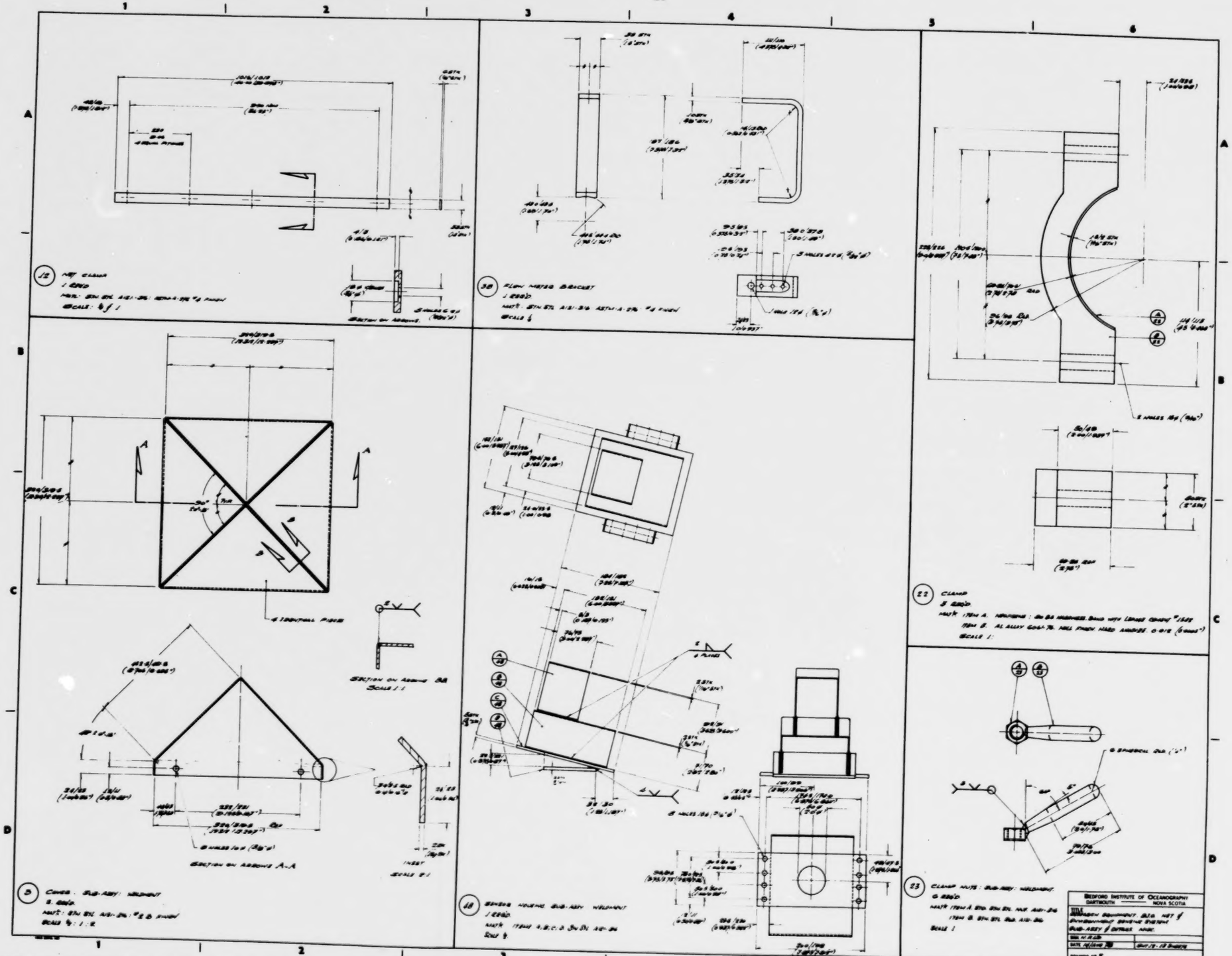
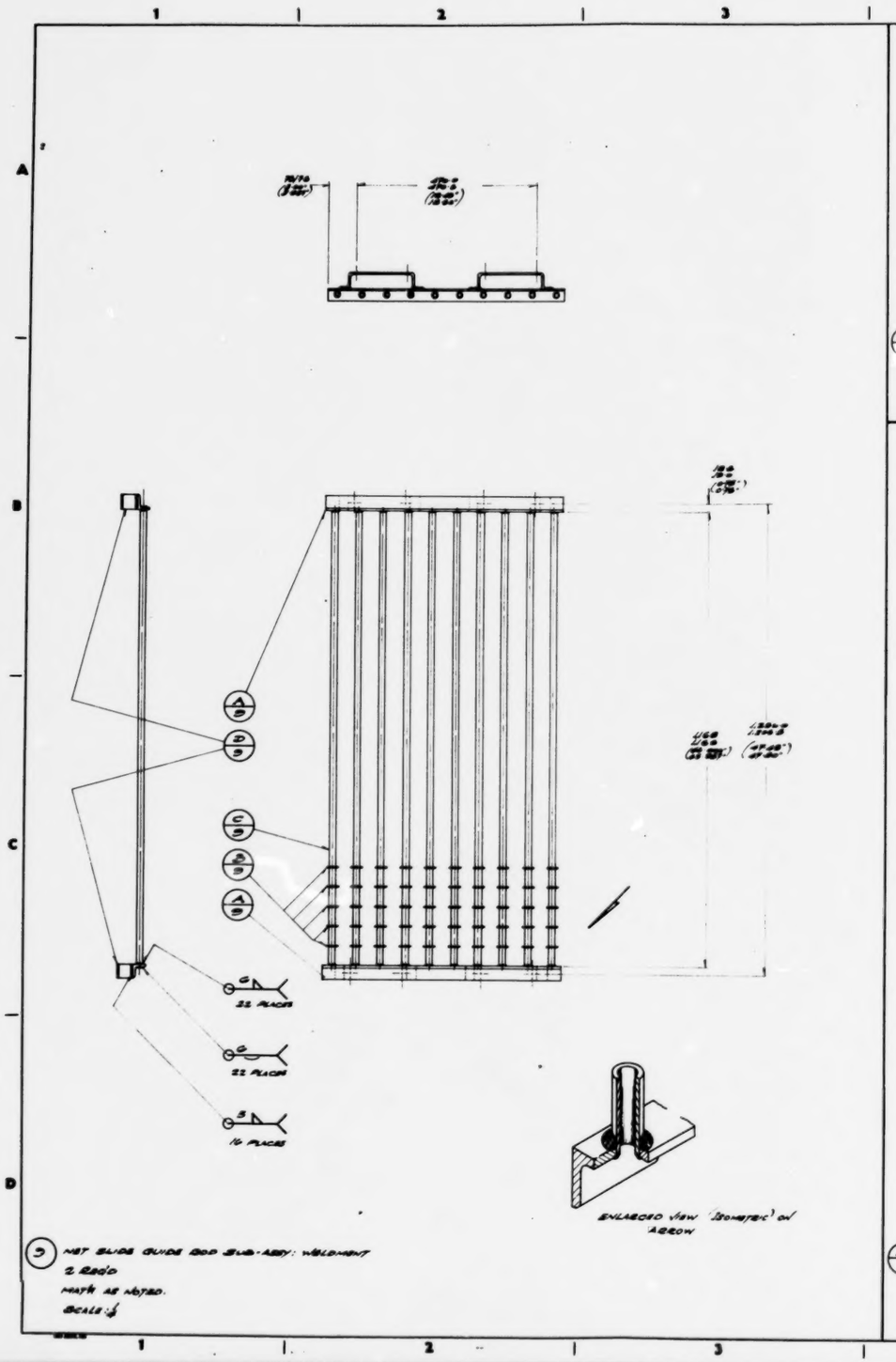

1
2
3
4
5
6
A
B
C
D
SECTION ON ASSEMBLY A-A
SECTION ON ASSEMBLY BB
SCALE 1:1
4 IDENTICAL PIECES
SCALE 1:2
SCALE 1:1
SCALE 1:1
SCALE 1:1

Fig. 9 Net slide guide rod subassembly, bar location, rod detail, clamp brackets, and net slide rings.



(3) NBT SLIDE GUIDE ROD SUB-ASSY: WELDMENT
2 REQ'D
MATR AS NOTED.
SCALE: ½

(2) GLIDE RAILS
2 REQ'D
MATR 15TH STL TUBE, AISI-304, ASTM-A-269, (0.720 kg/m)
SCALE 1/

(A) BAR LOCATION ANGLE
1 REQ'D
MATR 15TH STL AISI-316 (7.34 kg/m)
SCALE ½

(D) CLAMP BRACKETS
4 REQ'D
MATR 15TH STL AISI-316, ASTM-A-276, (0.359 kg/m)
SCALE ½

(B) NBT SLIDE RINGS
100 REQ'D
MATR: 15TH STL AISI-316
SCALE 2:1

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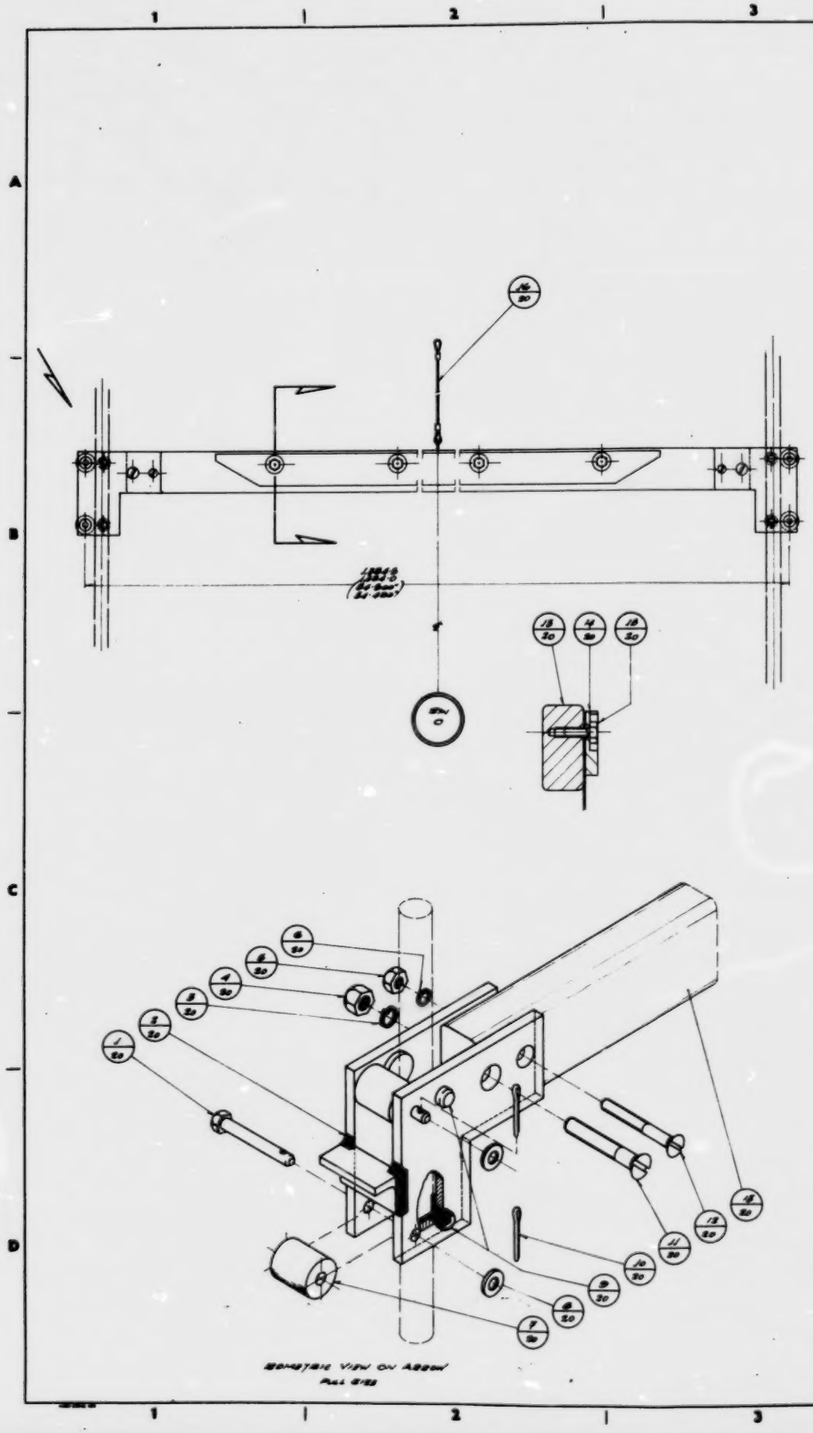
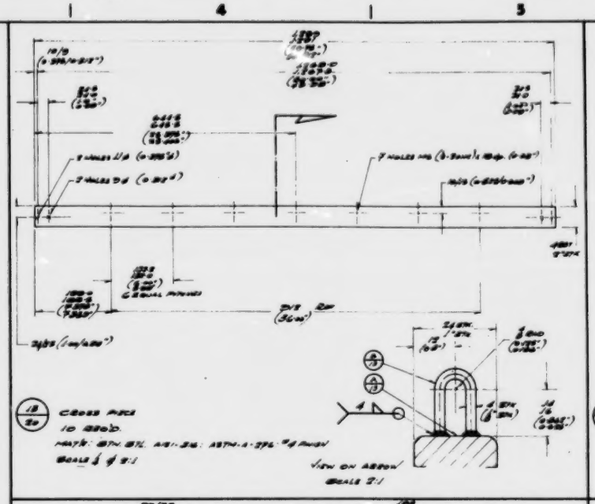
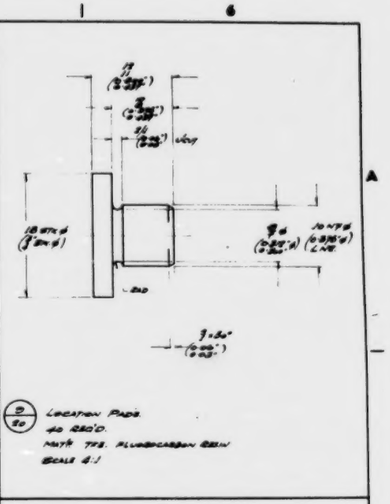
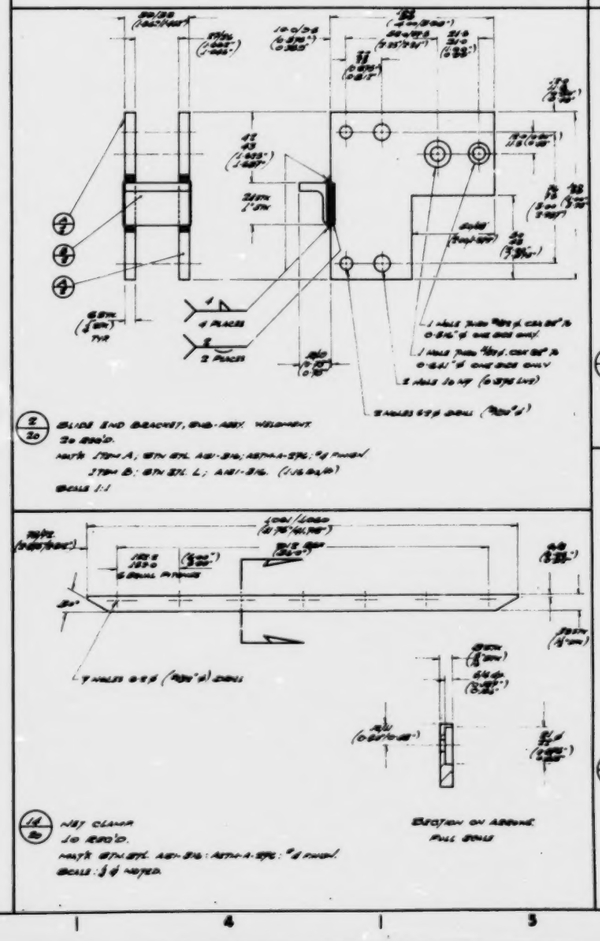
DARTMOUTH — NOVA SCOTIA
TITLE: RESEARCH EQUIPMENT: B.I.O. NBT 1
ENVIRONMENT SENSING SYSTEM
SUB-ASSY DRAWING: NBT SLIDE RINGS
DRN N.R. KEITH
DATE AUG 1981
DRAWING NO E

Fig. 10 Horizontal net bar assembly. Cross piece, location pads, slide end bracket, rollers, net clamp, and roller pin.









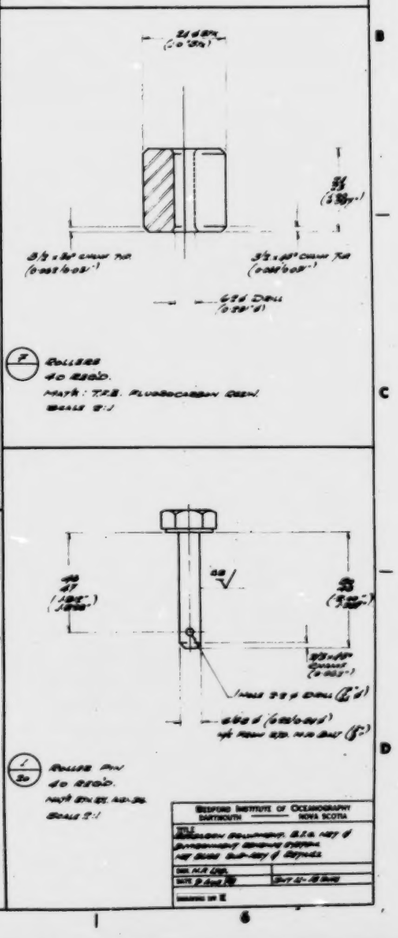


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Fig. 11 Microswitch cam assembly. Clamp, spacer, finger stop bar, microswitch cam finger subassembly, clamp block, cam finger assembly, cam shaft, spacer thrust washer, lockwasher, microswitch cam, and microswitch cam shaft.

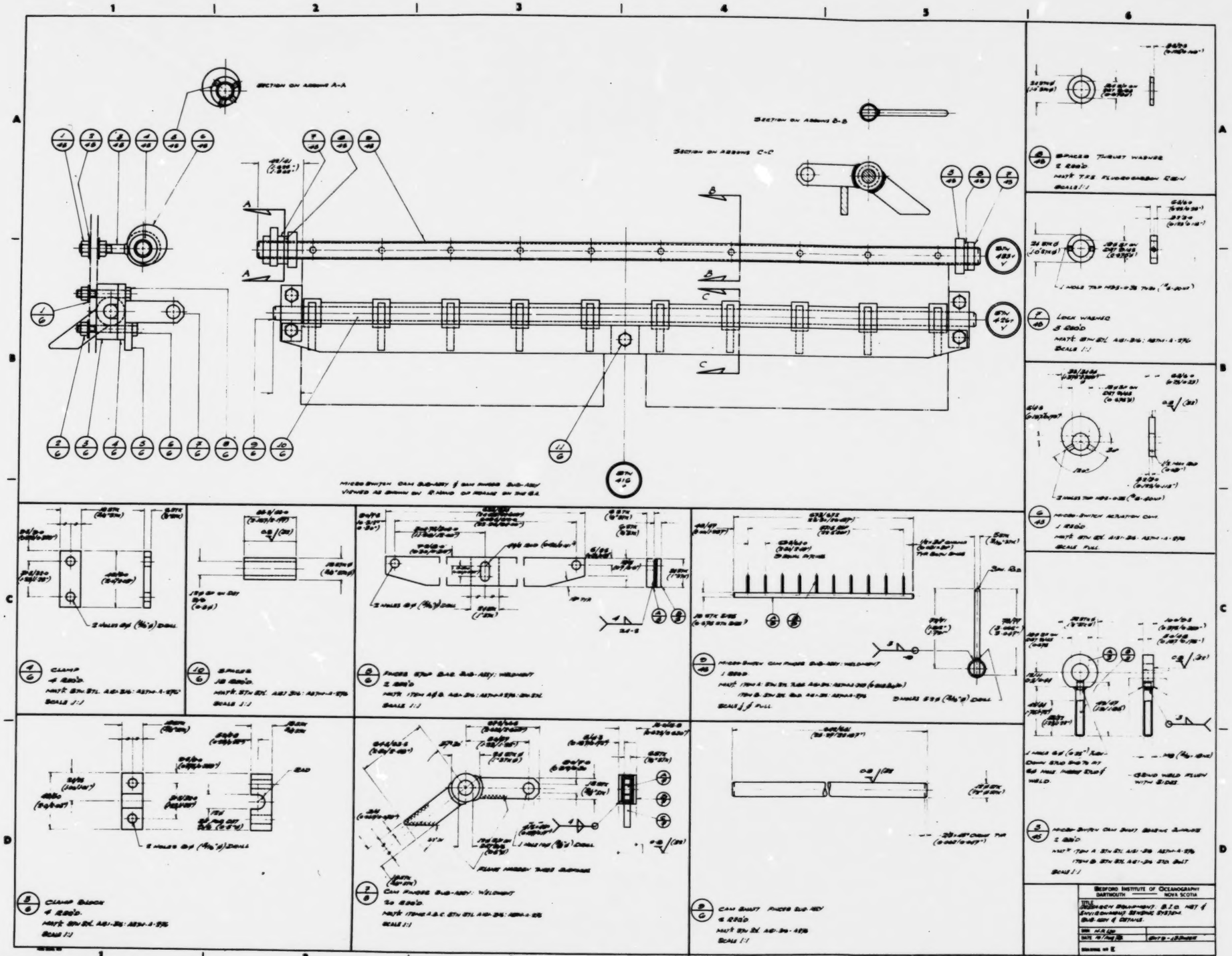

SECTION ON ASSEMBLY A-A
SECTION ON ASSEMBLY B-B
SECTION ON ASSEMBLY C-C
MICRO SWITCH CAM SUB-ASSY & CAM FINGER SUB-ASSY
VIEWED AS SHOWN ON B-BEND OF HOUSING ON SHT G1
CLAMP
4 REQ'D.
MATL STN STL. AISI 316; ASTM-A-276
SCALE 1:1
SPACER
10 REQ'D.
MATL STN STL. AISI 316; ASTM-A-276
SCALE 1:1
CAM FINGER SUB-ASSY: WELDMENT
2 REQ'D.
MATL ITEM A,B,C STN STL AISI 316; ASTM-A 276
SCALE 1:1
MICRO SWITCH CAM SUB-ASSY: WELDMENT
1 REQ'D.
MATL ITEM A & B STN STL AISI 316; ASTM-A 276; STN STL
ITEM C STN STL BAR AISI 316; ASTM-A 276; STN STL
SCALE 1:1
2 HOLES DIA (7/16")DRILL
CLAMP BLOCK
4 REQ'D.
MATL STN STL. AISI 316; ASTM-A-276
SCALE 1:1
CAM SHAFT FINGER SUB ASSY
4 REQ'D
MATL STN STL AISI 316 - 416
SCALE 1:1
SPACER THRUST WASHER
2 REQ'D
MATL TFE FLUOROCARBON RESIN
SCALE 1:1
LOCK WASHER
2 REQ'D
SCALE 1:1
MICRO SWITCH ACTUATOR CAM
1 REQ'D
MATL STN STL. AISI 316 - ASTM-A-276
SCALE FULL
CAM SHAFT BEARING SUPPORT
2 REQ'D
ITEM A STN STL AISI 316 ASTM-A-276
ITEM B STN STL AISI 316 STD. SHAFT
SCALE 1:1
WELD FILLET WITH 1/8 DIA.
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE MASSACHUSETTS
TITLE
OCEANOGRAPH EQUIPMENT, B.I.O. MET &
ENVIRONMENTAL SENSING SYSTEM
SUB-ASSY & DETAILS
DRN H.R.GM
DATE 10/MAY/65
DWG NO. E
SHEET NO. 2 OF 2 SHEETS

Fig. 12 Flow meter subassembly. Pulley, top bracket, slide tube, location blocks, sliding bracket, meter bracket, and spacer.

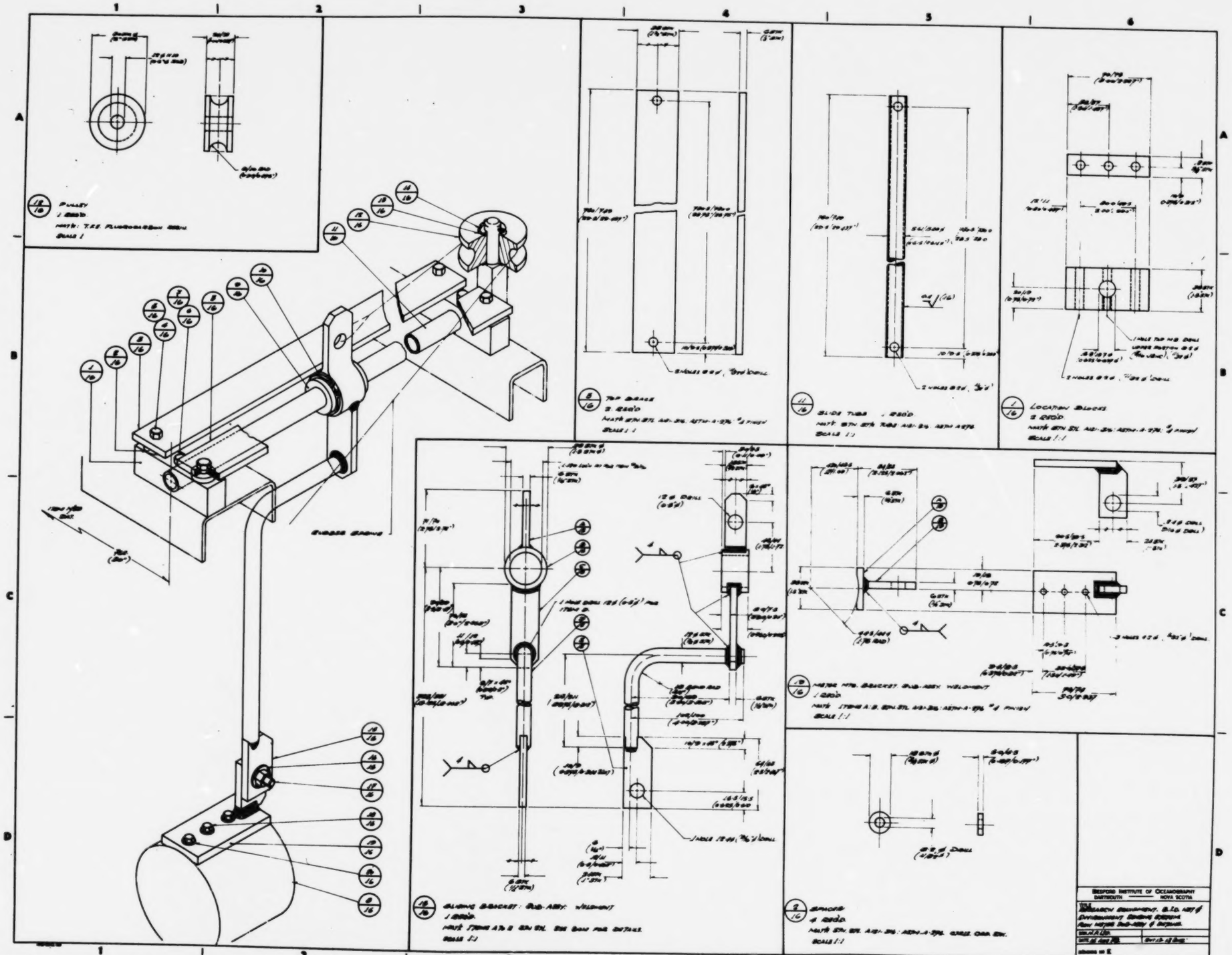

1
2
3
4
5
6
A
B
C
D
Pulley
1 req'd
Scale 1
Top Bracket
2 req'd
Scale 1:1
Slide Tube
1 req'd
Scale 1:1
Location Blocks
2 req'd
Scale 1:1
Slide Assembly
1 req'd
Scale 1:1
Motor Mtg. Bracket Sub-Assy. Weldment
1 req'd
Scale 1:1
Spacer
4 req'd
Scale 1:1
Bedford Institute of Oceanography
Dartmouth — Nova Scotia

Fig. 13 Depressor or drag plate details. Top plate, rear and front door, lifting lug, location bearing bracket, pivot shaft, spacer, torsion spring, lug bolt, end weights.

Fig. 14 Depressor frame subassembly. Spring securing post, pivot shaft securing bracket, reinforcement brackets.

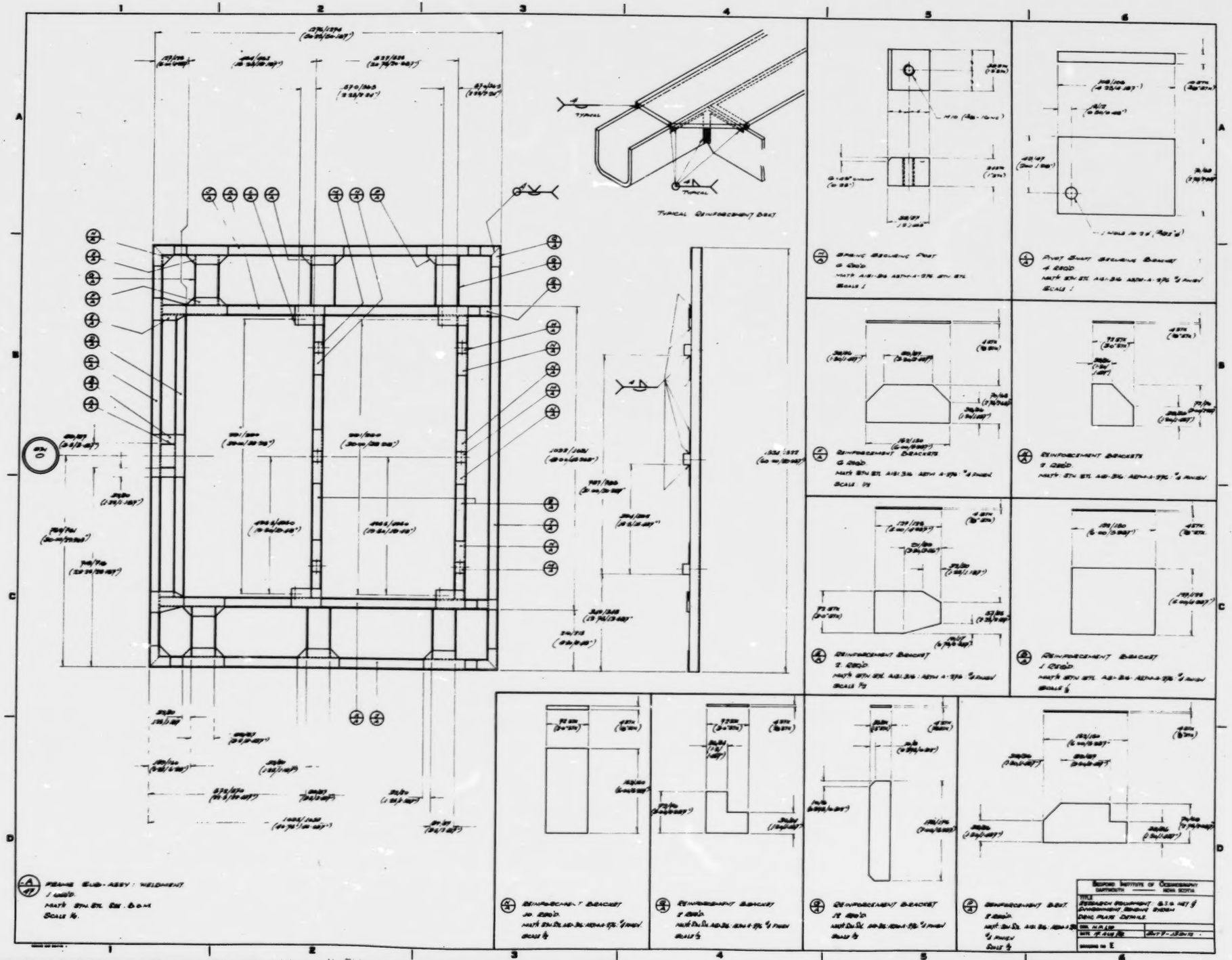

TYPICAL REINFORCEMENT DET.
FRAME SUB-ASSY : WELDMENT
1 REQ'D.
MATL STN STL SEE B.O.M.
SCALE 1/6
REINFORCEMENT BRACKET
10 REQ'D.
REINFORCEMENT BRACKET
2 REQ'D.
REINFORCEMENT BRACKET
12 REQ'D.
REINFORCEMENT BRACKET
2 REQ'D.
SCALE 1/2
REINFORCEMENT BRACKET
6 REQ'D.
SCALE 1/2
REINFORCEMENT BRACKET
4 REQ'D.
SCALE 1/2
REINFORCEMENT BRACKET
1 REQ'D.
SCALE 1/2
PIVOT SHAFT BEARING BRACKET
4 REQ'D.
SCALE 1
REINFORCEMENT BRACKET
2 REQ'D.
SCALE 1/2
REINFORCEMENT PLATE
2 REQ'D.
SCALE 1/2
DRAWING No. E

Fig. 15 Depressor subassembly.

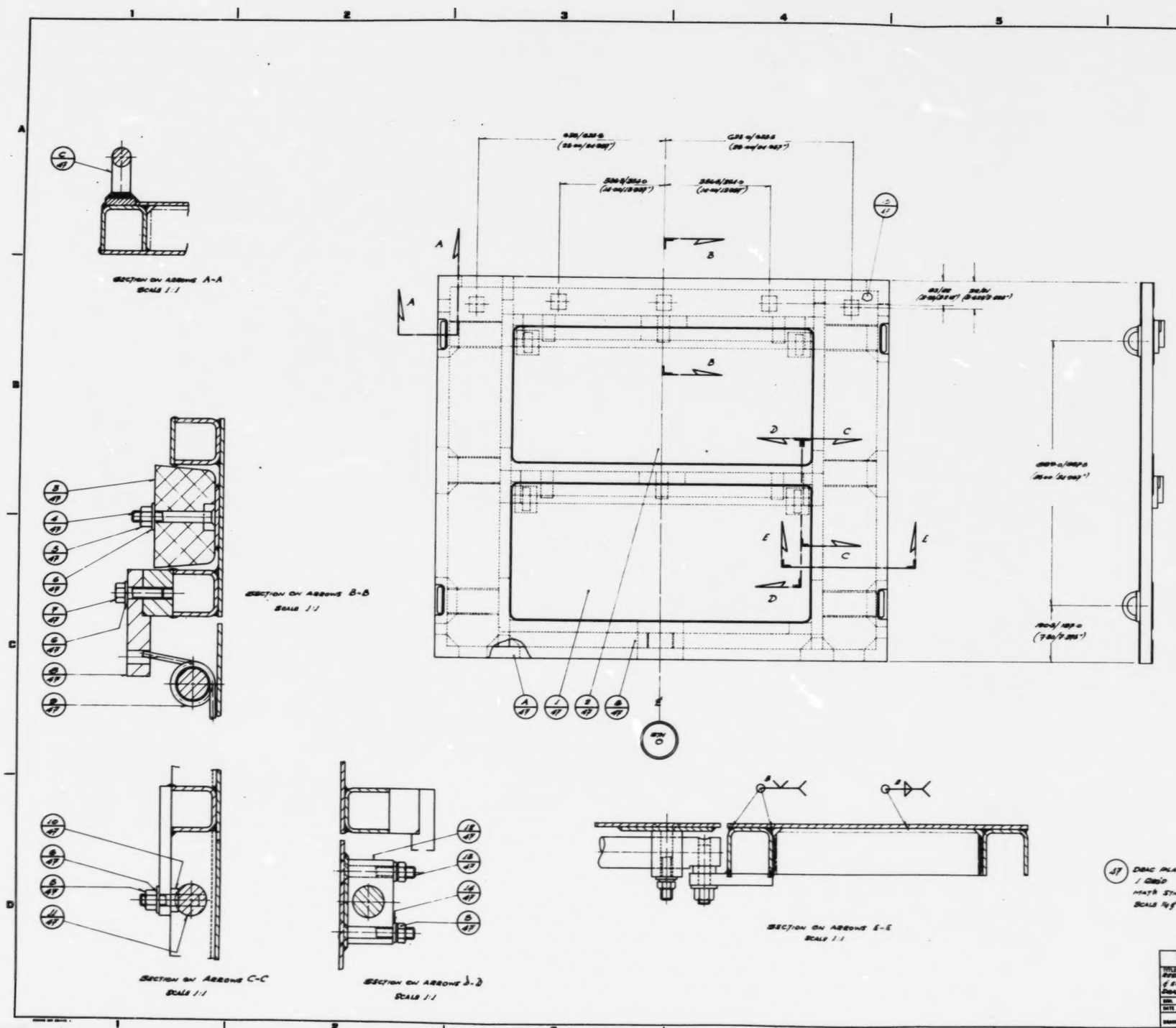
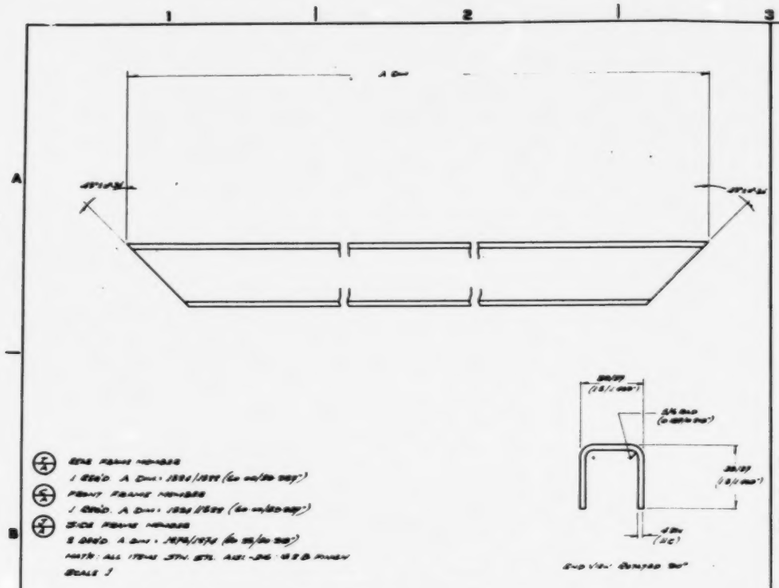

SECTION ON ARROWS A-A
SCALE 1:1
SECTION ON ARROWS B-B
SCALE 1:1
SECTION ON ARROWS C-C
SCALE 1:1
SECTION ON ARROWS D-D
SCALE 1:1
SECTION ON ARROWS E-E
SCALE 1:1
(47) DRAG PLATE SUB-ASSY WELDMENT / GRID
MATL STK STK SEE BOM
SCALE 1/4 F.S.
BEDFORD INSTITUTE OF OCEANOGRAPHY
DARTMOUTH NOVA SCOTIA
TITLE
RESEARCH REQUIREMENT B.I.O. NET & ENVIRONMENT SENSING SYSTEM
DRAG PLATE SUB-ASSY
DRN. N.R.A.Ltd.
DATE 18 JUNE 78
DRAWING No E

Fig. 16 Depressor rear frame member, front brace, spring locator, reinforcement bracket, shackle chain subassembly and depressor weight.


1
2
3
4
5
6
A
B
C
D
A Dim
Side View Opened Up
End View Opened Up
Scale 1
Scale 1/4
Scale 1/2
Scale 1/8
Scale 1/6
Scale 1/12
Scale 1/16
Scale 1/24
Scale 1/32
2 Holes in U.P.
2 Holes
45 Links
21 Links
Note: All items STN BTL Assy - 45° B Finish
Note: All items STN BTL Assy - 90° B Finish
Note: Use 4" Std Channel A36 M-36
At Outside Handle
Scale 1/4
Scale 1/2
Scale 1/8
Scale 1/6
Scale 1/12
Scale 1/16
Scale 1/24
Scale 1/32

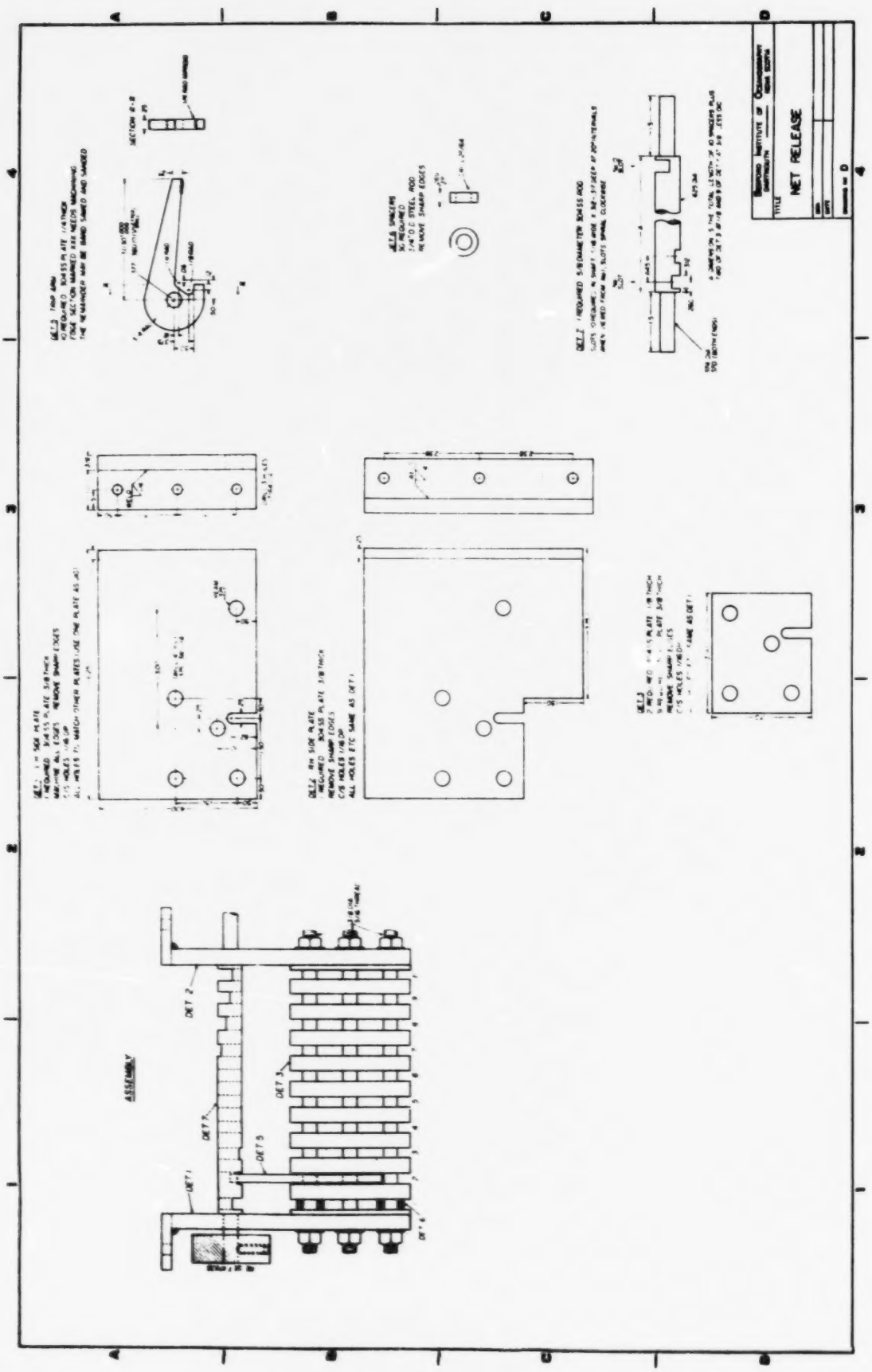


Fig. 17 The net release mechanism.

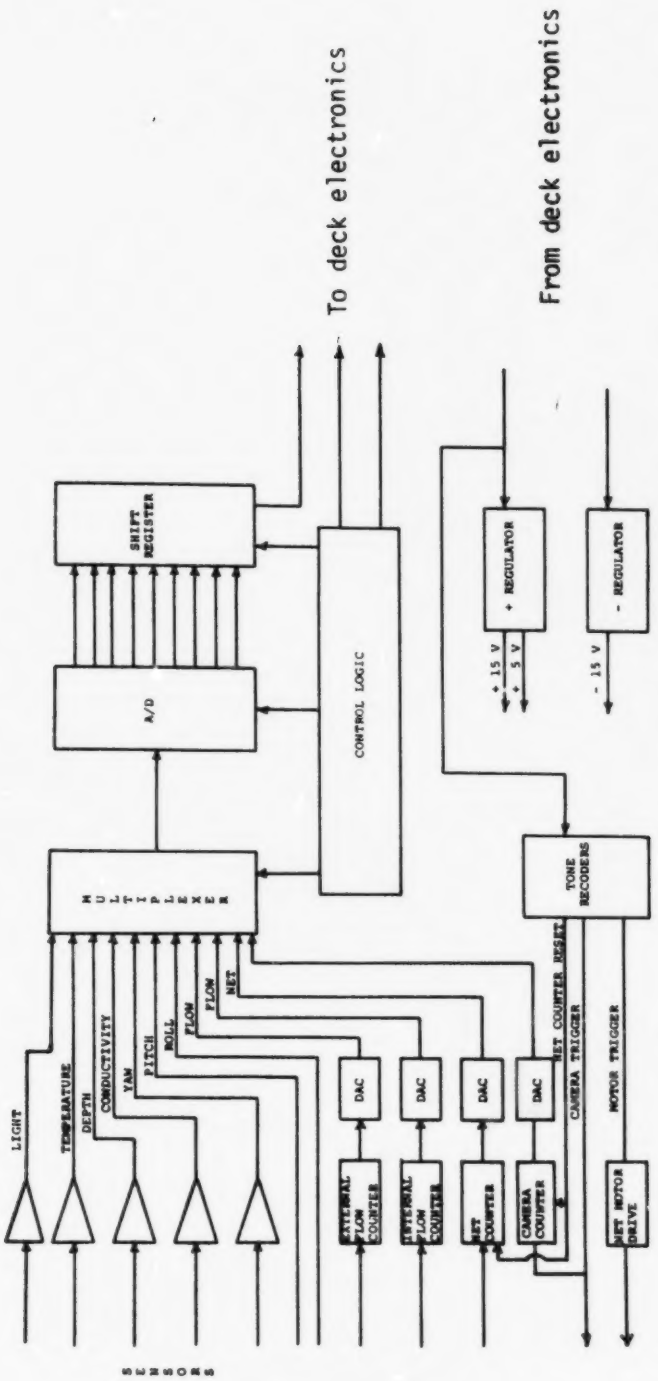


Fig. 18 Schematic diagram of underwater electronics.

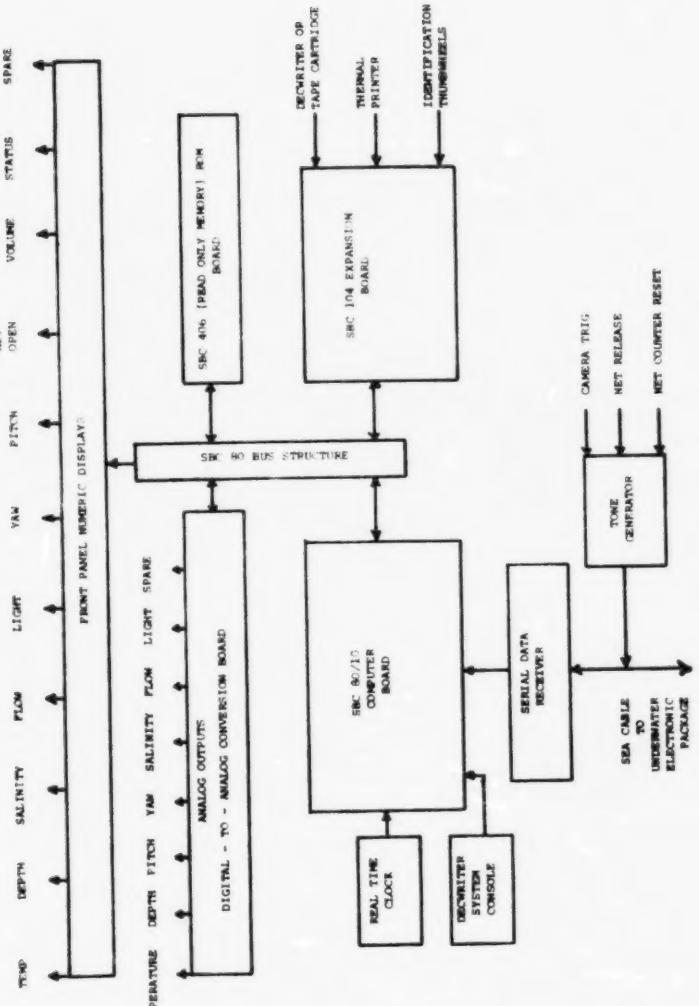
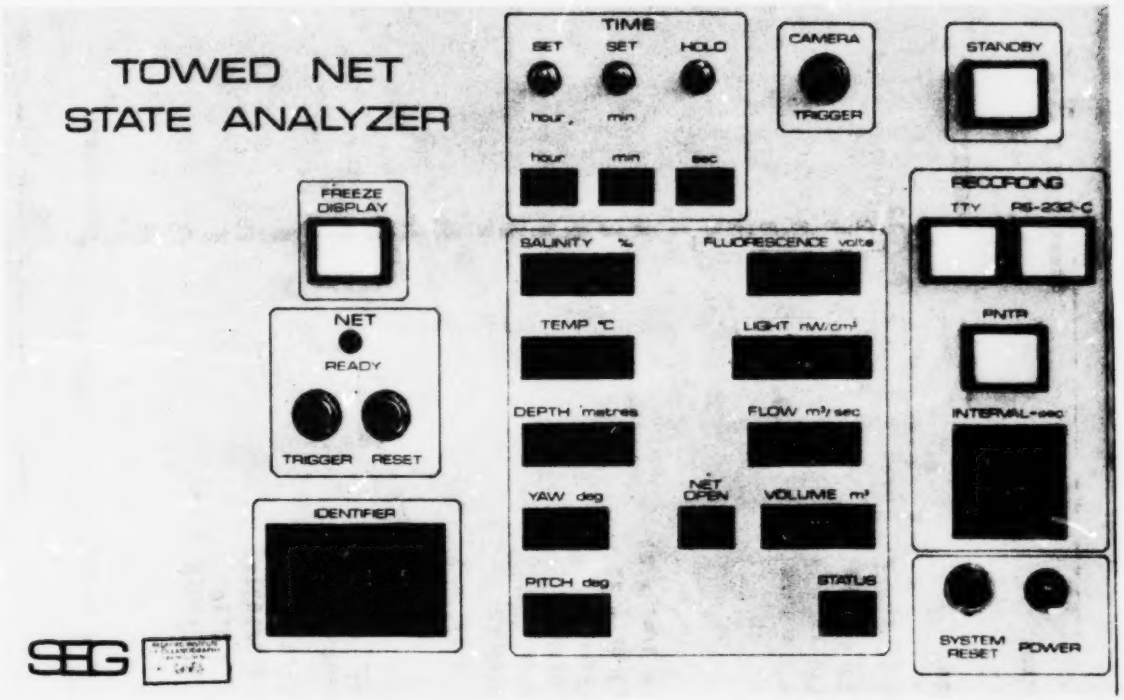


Fig. 19 Schematic diagram of deck electronics.



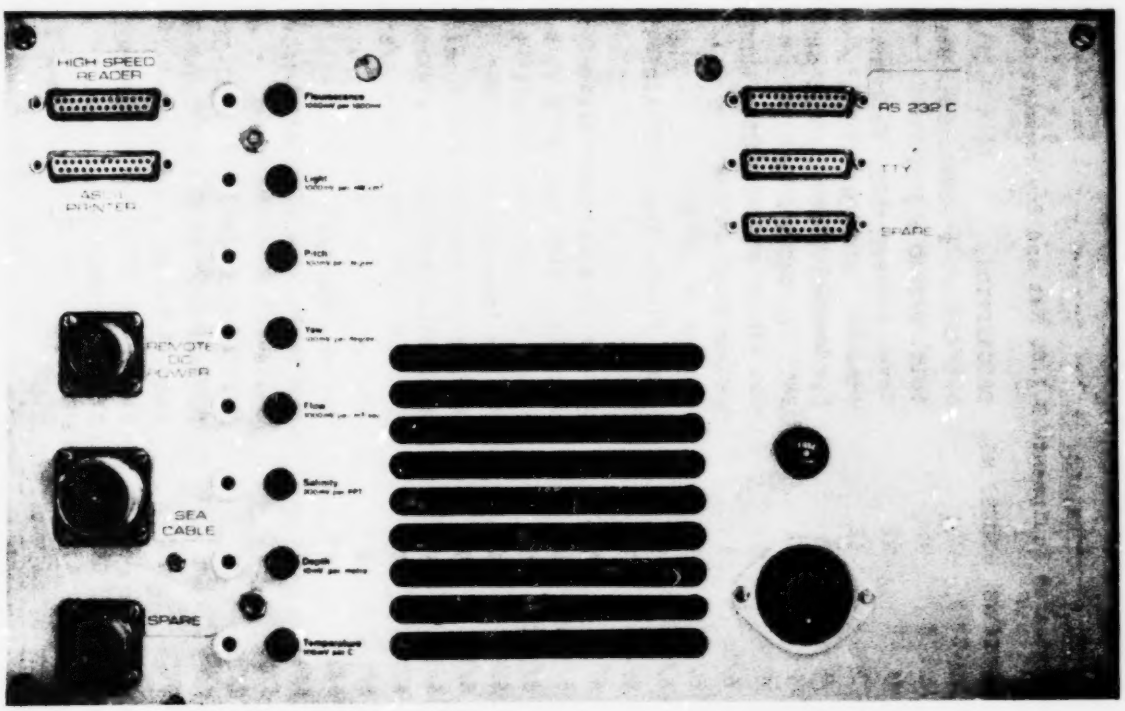


Fig. 20 Photograph of the deck display and microprocessor unit, front(above) and back (lower).

Table 1 List of all materials needed for the frame construction

BILL OF MATERIALS:

Research Equipment. B.I.O. Net and Environment Sensing System.

Sheet 1 of 8 shts.

ITEM NO	SHEET NO.	DESCRIPTION.	QUANTITY.
1	1	Nut/Washer. ¼"-20NC. Stn. Stl. AISI-316	8
2	1	Bolt. ¼-20NC x ½"lg. " " " "	12
3	12	Cover Sub-Assembly. Weldment.	2
3/A	12	Stn. Stl. AISI-316: 13ga. x 9-3/4" x 12 5/16"	8
4	1	Nut/Washer. ¼-20NC. Stn. Stl. AISI-316	8
5	1	Bolt. ¼-20NC x 2"lg. " " " "	8
6	9	CAM FINGER SUB-ASSEMBLY: WELDMENT.	2
6/1	1	As per item 4	
6/2	1	" " " "	
6/3	9	Clamp Block. Stn. Stl. AISI-316: 3/4" x 3/4" x 2"	4
6/4	9	Clamp. " " " " : ¼" x 3/4" x 2"	4
6/5	9	Finger Stop Bar. Sub-Assembly. Weldment	2
6/5/A	9	Stn. Stl. AISI-316: ¼" x 1" x 24 5/8"	2
6/5/B	9	" " " " . ¼" x 1" x 1"	2
6/6	1	As per Item 5	
6/7	9	Finger Sub-Assembly. Weldment.	20
6/7/A	9	Stn. Stl. AISI-316: ¼" x 3/4" x 2 1/8"	20
6/7/B	9	" " " " : 1"ø x 5/8"lg.	20
6/7/C	9	" " " " : ¼" x 3/4" x 2"	20
6/8	1	As per item 6/6	
6/9	9	Cam Shaft. Stn. Stl. AISI-316: ½"ø x 25¼"lg.	2
6/10	9	Spacers. " " " " : 3/4"ø x 2 3/16"lg.	18
6/11	9	Bolt/Washer. Stn. Stl. AISI-316: ¼-20NC x ½"lg.	2
7	1	Nut Washer.7/16 I/D x 1"O/D. Stn. Stl. AISI-316	16
8	1	Bolt. 3/8-16NC x 1" Lg. " " " "	16
9	10	NET SLIDE GUIDE ROD SUB-ASSEMBLY.	2
9/A	10	Stn. Stl. AISI-316: Angle. ¼" x 1½" x 1½" x 24 7/16":(2.34 lbs/ft.)	4
9/B	10	" " " " : 1/16"ø x 3.14"lg.	100

Table 1(continued)

BILL OF MATERIALS: Sheet 2

Research Equipment. B.I.C. Net and Environment Sensing System.

ITEM NO.	SHEET NO.	DESCRIPTION.	QUANTITY.
9/C	10	Stn. Stl. AISI-316: Tube. 0.675" O/D x 46½"lg. (0.739 lbs/ft.)	20
9/D	10	" " " " : 3/16" x 1½" x 10 13/16"	4
10	1	Flat Washers 9/32" I/D x 5/8"O/D. Stn. Stl. AISI-316:	4
11	1	Bolt/Nut. ¼-20NC. x 1"lg. " " " " :	4
12	12	Net Clamp Sub-Assembly.	1
12/	12	Stn. Stl. AISI-316: ¼" 1½" x 40"	1
13	--	NET SUB-ASSEMBLY: See Specification Sheet.	10
14	1	Nut /Washer ½"-13NC. STN. STL. AISI-316:	1
15	1	Bolt. ½"-13NC. x 1"lg. " " " " :	1
16	13	SLIDING FLOW METER SUB-ASSEMBLY.	1
16/1	13	Stn. Stl. AISI-316: Loc'n. Block. 3/4" x 1½" x 3"	2
16/2	13	" " " " : Spacer. 3/4" ø x 3/16"lg.	4
16/3	13	" " " " : Top Brace. ¼" x 1½" x 29¼"	2
16/4	13	" " " " : Bolt 5/16"-18NC x 2½"lg.	4
16/5	13	" " " " : Nut/Washer. 5/16"-18NC.	4
16/6	13	" " " " : Bolt. 5/16"-18NC x 1½"lg.	2
16/7	13	" " " " : Lock Washer. 5/16"	2
16/8	13	Flow Meter. Type:-	1
16/9	13	Ball Bushing. Type:-	1
16/10	13	Circlip. Outside. Type:	2
16/11	13	Stn. Stl. AISI-316: Slide Tube. 5/8" O/D x 16ga. Wall. x 29½"lg.	1
16/12	13	T.F.E. Fluorocarbon Resin. Pulley. 2"ø x 1"	1
16/13	13	Stn Stl. AISI-316: Washer. 9/16" I/D x 3/32"thk.	2
16/14	13	" " " " : Split Pin. 1/8" ø x 1"lg.	1
16/15	13	Slide Bracket Sub-Assembly. Weldment.	1
16/15/A	13	Stn. Stl. AISI-316: ¼" x 3/4" x 2"	1
16/15/B	13	" " " " :1½"ø x 31/32"lg.	1
16/15/C	13	" " " " : ¼" x 1" x 3"	1
16/15/D	13	" " " " : ½"ø x 12"lg.	1
16/15/E	13	" " " " : ¼" x 1" x 2½"	1

Table 1(continued)

BILL OF MATERIALS — Sheet 3

Research Equipment. B.I.O. Net and Environment Sensing System.

ITEM NO.	SHEET NO.	DESCRIPTION.	QUANTITY.
16/16	13	Stn Stl. AISI-316: Washer. 9/16" I/D.x 1" O/D.	2
16/17	13	" " " " : Bolt/Nut. ⅜"-13NC. x 1" lg.	1
16/18	13	" " " " : Bolt #10-32NC x ½"lg.	3
16/19	13	Meter Mounting Bracket. Sub-Assembly. Weldment.	1
16/19/A	13	Stn. Stl. AISI-316: ¼" x 1½" x 3"	1
16/19/B	13	" " " " : ¼" X 1"x 1 3/4"	1
16/20	13	" " " " : Washer. 7/32"I/D. x 3/8"O/D.	3
17	1	See det 17/11	
18	1	" " 17/12	
19	1	" " 17/15	
20	11	NET SLIDE SUB-ASSEMBLY.	10
20/1	11	Stn. Stl. AISI-316: Roller Pin. Mfg. from 3/8" x 2"lg bolt.	40
20/2	11	Slide End Bracket Sub-Assembly. Weldment.	20
20/2/A	11	Stn. Stl. AISI-316: ¼" x 4" x 4"	20
20/2/B	11	" " " " :Angle.3/16" x 1" x 1"x 1 9/16"	20
20/3	11	" " " " :5/16" Spring Washer	20
20/4	11	" " " " :Nut. 5/16-18NC.	20
20/5	11	" " " " :Nut. ¼-20NC.	20
20/6	11	" " " " :Spring Washer. ¼"	20
20/7	11	T.F.E. Fluorocarbon Roller: 1"ø x 1"lg.	40
20/8	11	Stn. Stl. AISI-316: Flat Washer. 9/32"I/D. x 1/16"thk.	40
20/9	11	T.F.E. Fluorocarbon Resin: Loc'n Pads. 3/4"ø x ½"lg.	40
20/10	11	Stn. Stl. AISI-316: Split Pin. 3/32" x 3/4"lg.	40
20/11	11	" " " " :5/16"-18NC x 2"lg. Flat Hd. Scrs.	20
20/12	11	" " " " : ¼-20NC. x 2"lg, " " " .	20
20/13	11	Cross Piece Sub-Assembly. Weldment.	10
20/13/A	11	Stn. Stl. AISI-316: 1" x 2" x 50 3/4"	10
20/13/B	11	" " " " : 1/8"ø x 1 23/32"lg.	10
20/14	11	" " " " : Net Clamp. 5/16" x 1½" x 41 3/4"	10

Table 1(continued)

BILL OF MATERIALS:

Sheet 4

Research Equipment. B.I.O. Net and Environment Sensing System.

ITEM NO	SHEET NO.	DESCRIPTION	QUANTITY.
20/15	11	Stn. Stl. AISI-316: Bolt . ¼-20NC.-3/4"lg.	70
20/16	11	" " " " : Wire Lead. 1/3"-6/19 lay. Lgth. to suit on Assy Duraloc wire harness assembly. c/w. ferrules.	10
21	1	Electronics Pod #4	1
22	12	Clamp Assembly.	3
22/A	12	1/16" x 2" x 5 3/4" Neoprene Pad.	3
22/B	12	2" x 2 3/4" x 9.0" Al. Alloy 6061-T6. Hard anodize.	3
23	12	Clamp Nut Sub-Assembly.	6
23/A	12	Stn. Stl. AISI-316:½-13NC Nut.	6
23/B	12	" " " " :½"ø x 3 3/32lg.	6
24	1	Electronics Pod #3	1
25	1	Stn. Stl. AISI-316: Jubilee Hose Clips. Size 6-8"ø.	2
26	1	" " " " : Nut/Washer. ¼"-20NC.	6
27	1	" " " " : Bolt. ¼-20NC x 1"lg.	6
28	1	Net Slide Trigger Assembly.	1
29	1	See Items 14/15/16. Sheet #2 this B.O.M.	
30	1	" " " " " " "	
31	1	" " " " " " "	
32	1	Electronics Pod #2.	1
33	1	" " #1	1
34	1	Stn. Stl. AISI-316: 5/16-18NC. Nut.	1
35	1	" " " " : 5/16-18NC x 1"lg. Bolt	1
36	1	" " " " : #10-32NC Nut/Washer	3
37	1	" " ". " : #10-32NC x ½"lg Bolt.	3
38	12	Flow Meter Bracket: Stn. Stl. AISI-316: 3/8" x 1½" x 10 5/8"	1
38/1	1	Flow Meter. Type:-	1
39	2	MAIN FRAME SUB-ASSEMBLY. WELDMENT	1
39/A	4	Stn. Stl. AISI-316: Cam Guard. ¼"x 4" x 28"	1
39/B	4	" " " " " " ¼"x 4" x 28"	1

Table 1(continued)

BILL OF MATERIALS:

Research Equipment. B.I.O. Net and Environment Sensing System.

Sheet 5

ITEM NO.	SHEET NO.	DESCRIPTION.	QUANTITY.
39/C	4	Stn. Stl. AISI-316: 3/8"x 5"x 11 7/8".	1
39/D	4	" " " " : 3/8"x 5"x 11 7/8".	1
39/E	4	" " " " : Angle. ¼" x 2" x 2" x 2 3/8"lg. (3.19 lbs/ft.)	2
39/F	4	" " " " : " ¼" x 2" x 2" x 2 3/8"lg. (3.19 lbs/ft.)	2
39/G	4	" " " 304: Sq. Tube. 1½' x 1½" x 16ga. x 66½"lg.	2
39/H	4	" " " " : " " . 1½" x 1½" x 16ga. x 30"lg.	2
39/J	4	" " " 316: ¼" x 30" x 59"	1
39/K	4	" " " " : ¼" x 30" x 59"	1
39/L	4	" " " " : ¼" x 1½" x 57½"	1
39/M/A	4	" " " " : 3/4"ø x 36"lg	2
39/M/B	4	" " " " : 3/4"ø x 12½"lg.	2
39/N	3	Top Bracket Sub-Assembly. Weldment.	1
39/N/A	3	Stn. Stl. AISI-316: Clamp Stud. ½"øx 7½"lg.	6
39/N/B	3	" " " " : Front Strut. 12ga. x 6" x 57¼"	1
39/N/C	3	" " " " : Brace. ¼" x 1" x 7 3/4"	2
39/N/D	3	" " " " : Angle. 3/16" x 1" 1" x 26½"	1
39/N/E	3	" " " " : Stud Support. ½" x 2" x 9 3/4"	1
39/N/F	3	" " " " : Angle. 3/16" x 1" 1" x 26½"	1
39/N/G	3	" " " " : Brace. ¼" x 1 " x 4¼"	2
39/N/H	3	" " " " : Rear Strut. 12ga. x 4½" x 57¼"	1
39/N/J	3	" " " " : Pod Brkt. Angle. ¼" x 2" x 2" x 8¼"	1
39/N/K	3	" " " " : Pulley Pin. 5/8"sq. x 4 3/8"	1
39/N/L	3	" " " " : Bar. 3/4" x 12 3/8"	1
39/N/M	3	" " " " : Stud Support. ½" x 2" x 15 3/4"	2
39/N/P	3	" " " " : Pipe. Sch. 40. 1"ø x 6 3/4"lg.	1
39/N/Q	3	" " " " : Pod Brkt. Angle. ¼" x 2" x 2" x 6½"	1
39/N/R	3	" " " " : Support. ¼" x 2" x 3 3/4"	1
39/N/S	3	" " " " : Channel. 12ga.x 12" x 12"	1
39/N/T	3	" " " " : Hook. 3/16"ø x 5"	1
39/N/X	3	" " " " : Channel. 12 ga. x 7" x 28"	1

Table 1(continued)

BILL OF MATERIALS: Sheet 6

Research Equipment. B.I.O. Net and Environment Sensing System.

ITEM NO.	SHEET NO.	DESCRIPTION.	QUANTITY.
39/N/U	3	Stn. Stl. AISI-316: Brace. ¼" x 3/4" x 8"	1
39/N/V	3	" " " " : Brace. ¼" X 3/4" x 16"	1
39/N/W	3	" " " " : Brace. ¼" x 3/4" x 12"	1
39/P	2	" " " " : Support Brkt. ¼" x 1½" x 3½"	2
39/Q	2	" " " " : Angle. 3/16" x 1" x 1" x 56"	2
39/R	2	Hook Sub-Assembly. Weldment.	2
39/R/A	2	Stn. Stl. AISI-316: Hook. 1/8"ø x 1 5/8"lg.	20
39/R/B	2	" " " " : Brkt. 1/8" x 3/4" x 24"	2
40	1	" " " " : Nut/Washer. #10-32NC.	3
41	1	" " " " : Pan Hd. Scrs. #10-32NC x 1¼"lg.	3
42	1	Micro-Switch Sub-Assembly. Type:-	1
43	1	See Item 45/1	
44	1	See Item 45/2	
45	9	Micro-Switch Cam Sub-Assembly.	1
45/1	9	Stn. Stl. AISI-316: 5/16-18NC. Nut	4
45/2	9	" " " " : Washer. 5/16"	4
45/3	9	Bearing Shaft Support Sub-Assembly. Weldment,	2
45/3/A	9	Stn. Stl. AISI-316: Bearing. 1¼"ø x 3/8"lg,	2
45/3/B	9	" " " " : Stud. 5/16"ø x 1 3/4"lg.	2
45/4		Not Used.	
45/5	9	Stn. Stl. AISI-316: Grub Screws, # 6 - 40NC.	6
45/6	9	" " " " : Cam. 1 3/8"ø x ¼"lg.	1
45/7	9	" " " " : Lock Washer. 1"ø x ¼"lg.	3
45/8	9	T.F.E. Fluorocarbon Resin. 1"ø x 1/8"lg.	2
45/9	9	Cam Finger Sub-Assembly. Weldment.	1
45/9/A	9	Stn. Stl. AISI-316: Tube. 0.675ø x 16ga wall. x 26½"lg.	1
45/9/B	9	" " " " : Rod. 3/16"ø x 3 3/64"lg.	10
46	6	Shackel Chain Sub-Assembly.	2
46/1	6	Galvanised Shackels ¼" HC 4000.	6
46/2	6	Chain Galvanised. ¼" HC. 2500. 43 Links.	2

Table 1(continued).

BILL OF MATERIALS: Sheet 7

Research Equipment. B.I.O. Net and Environment Sensing System.

ITEM NO	SHEET NO.	DESCRIPTION.	QUANTITY.
46/3	9	Load Rope Link. ¼" Steel core, 6 x 19 lay, x 10" Finished lg. Galvanised with Duraloc Splice, c/w. ferrules.	2
46/4		Safety Link. Wire Rope. ¼" Steel core, 6 x 19 lay. x 36" finished lg. Galvanised with Duraloc Splice., c/w ferrules.	2
47	5	DRAG PLATE SUB-ASSEMBLY. WELDMENT.	1
47/A	7	Drag Plate Frame Sub-Assembly. Weldment.	1
47/A/A	6	Stn. Stl. AISI-316: Brace. 11ga. x 1½" x 2"	2
47/A/B	7	" " " " : Reinforcement Brkt. 11ga. x 5" x 6"	1
47/A/C	6	" " " " : Front Frame Member. 11ga.x 4½" x 60"	1
47/A/D	6	" " " " : Front Brace. 11ga. x 4½" x 40"	1
47/A/E	7	" " " " : Reinforcement Bracket. 11ga. x 3" x 5"	2
47/A/F	7	" " " " : Reinforcement Bracket. 11ga. x 2 3/4" x 6"	6
47/A/G	7	" " " " : " " . 11ga. x 1½" x 7"	12
47/A/H	7	" " " " : " " . 11ga. x 3" x 3"	2
47/A/J	6	" " " " : Side Frame members. 11ga. x 4½" x 50¼"	2
47/A/K	6	" " " " : Side Brace. 11ga. x 4½" x 47¼"	2
47/A/L	7	" " " " : Pivot Shaft Brkt. 3/8" x 2 3/4" x 4¼"	4
47/A/M	7	" " " " : Spring Securing Post. 1" x 1½" 1½"	6
47/A/N	7	" " " " : Reinforcement Bracket. 11ga. x 3" x 6"	10
47/A/P	7	" " " " : " " . 11ga. x 2 3/4" x 6"	2
47/A/Q	7	" " " " : " " . 11ga. x 3" x 3"	2
47/A/R	7	As per item 47/A/N.	
47/A/S	6	Stn. Stl. AISI-316:Ctr. & Rear Brkt. 11ga x 4½" x 47¼"	2
47/A/T	6	" " " " :Rear Frame Member. 11ga. x 4½" x 60"	1
47/B	8	Top Plate Sub-Assembly.	1
47/B	8	Stn. Stl. AISI-316:Top Plate. 1/8" x 60" x 50¼"	1
47/1	8	Front Door Sub-Assembly. Weldment.	1
47/1/A	8	Stn. Stl. AISI-316: Door. 1/8" x 17 3/4" x 39½"	1
47/1/B	8	" " " " : Stiffner Plate. 11ga. 3"sq.	2

Table 1(continued)

BILL OF MATERIALS: Sheet 8

Research Equipment. B.I.O. Net and Environment Sensing System.

ITEM NO.	SHEET NO.	DESCRIPTION.	QUANTITY.
47/2	8	Rear Door Sub-Assembly. Weldment.	1
47/2/A	8	Stn. Stl. AISI-316:Top Plate. 11ga. x 17 3/4" 39¾"	1
47/2/B	8	" " " " :Stiffner Plate. 11ga. x 3"sq.	2
47/3	8	Lead Tin Alloy: 60/20. 122lbs.	
47/4	8	Lug Bolt Sub-Assembly. Weldment.	5
47/4/A	8	Stn. Stl. AISI-316: Plate 1/8" x 4"Sq.	5
47/4/B	8	" " " " : Stud. 3/8"ø x 2 3/4"lg.	5
47/5	5	" " " " : Nut. 3/8-16NC.	5
47/6	5	" " " " : Flat washer. 13/32"I/D. 1¼"O/D.	5
47/7	5	" " " " : Bolt. 3/8-16NC. x 1¼"lg	6
47/8	6	" " " " : Spring Locator. 3/4" x 1½" x 3"	6
47/9	8	" " " 304. Type 18-8. Torsional Spring. 3/16"ø x 27 7/8"	6
47/10	8	" " " 316: Spacer.3/4"ø x ¼"lg.	4
47/11	8	Pivot Shaft Sub-Assembly.	2
47/11/A	8	Stn. Stl. AISI-316:Stud. 3/8"ø x 2"	4
47/11/B	8	" " " " :Shaft. 1"ø x 39 15/16"lg.	2
47/12	8	" " " " :Loc'n. Bearing Brkt. 1" x 1½" x 2 3/4"	4
47/13	8	" " " " :Flat Hd. Scr. 3/8-16NC. x 2½"lg.	8
47/14	8	" " " " :Lock Washer. 3/8"	8
47/C	8	Lifting Lugs Sub-Assembly. Weldment.	4
47/C/A	8	Stn. Stl. AISI-316: 5/8"ø x 4 3/4"lg.	4
47/C/B	8	" " " " : 5/16" x 1" x 4"	4
48	12	Sensor Housing Sub-Assembly. Weldment.	1
48/A	12	Stn. Stl. AISI-316:16ga. x 3" x 10 3/8"	1
48/B	12	" " " " :16ga. x 6" x 10 5/8"	1
48/C	12	" " " " :3/16" x 6" x 7¼"	1
48/D	12	" " " " :3/16" x 3 3/4" x 6 7/8"	1
49	1	" " " " :Bolt/Nut. ¼-20NC x ½"lg.	4
47	6	Lead Tin Alloy: 60/20:27lbs	2

Table 2 Species list of animals collected in each net during a single tow off the edge of the Nova Scotia Shelf.

Table 2

ZOOPLANKTON DATA - SCOTIAN SHELF

DATE: June 5, 1978 LAT.: 42°30.5'N LONG.: 63°25'W

TOW 3

SAMPLE	1	2	3	4	5	6	7	8	9	10
TIME	0007	0011	0016	0021	0025	0030	0035	0040	0045	0050
DEPTH	0-7	7-20	20-52	50-71	71-90	91-120	118-120	120-150	147-200	200
TEMPERATURE	7.59	4.05	5.70	8.53	9.36	10.34	10.52	10.72	9.98	9.62
VOLTAGE[2]	-	0	0	0	.00095	.00077	.002	-	-	-
S_v(dB)	-	-	-	-	-30.22	-31.14	-26.99	-	-	-
AMPHIPODA										
Parathemisto gaudichaudi	5.3	.5	1.2	2.4	4.4	3.2	.4	.5	.6	.1
Parathemisto sp.	33.0	38.0	4.0	46.0	36.0	32.0	.9	6.0	4.0	.7
CALANOIDA										
Aetideus armatus			.3			.3		.2	.2	
Calanus finmarchicus		1475.0	113.0	10.0	9.0	11.0	7.0	10.0	11.0	.8
Calanus glacialis	11.0	13.0							1.0	.3
Calanus hyperboreus		54.0	9.0	9.0	2.0	2.0		1.0	1.0	4.0
Calanus sp. immature	1095.0	69.0	2.0	6.0	5.0	3.0	.8	.4	5.0	11.0
Candacia armata			.3							
Chirudina streetsii										.1
Clausocalanus arcuicornis				.2						
Euchaeta norvegica		13.0	1.0	.5	.3	.2	.1		.3	.1
Euchirella rostrata	2.0	2.0	1.0	.7	.9	2.0	.6	2.0	2.0	2.0
Gaidus tenuispinus										.7
Heterohabdus norvegicus				.9	.6	.1	.1	.1	.4	.4
Metridia longa										.1
Metridia lucens	4.0	8.0	29.0	20.0	12.0	2.0	1.0	1.1	.9	.4
Metridia sp. immature	6.0		10.0	6.0	4.0	3.0	2.0	.9	2.0	.3
Nannocalanus minor				.9	.8	.8	.2	.2		.1
Pleuromamma borealis	2.0			.5	.8	1.0	.3	.3	.2	.1
Pleuromamma robusta	2.0	2.0	.8	2.0	.5	.5	.5	.6	.8	2.0
Pleuromamma sp. immature				.2	.2					
Pseudocalanus minutus	4.0	2.0	.5	.5	.3	.1		.1	.1	.1
Scolecithricella minor			2.0	6.7	2.0	2.0	1.0	1.0	1.0	1.0
Scolecithricella sp. immature				.7						
Scottocalanus persecans										.1
CHAETOGNATHA										
Eukrohnia hamata										.1
Sagitta maxima										.2
Sagitta tasmanica		2.0	.5							
Unidentifiable	2.0		.3	.2	.3	.4	.1	.1		.1
CYCLOPOIDA										
Oithona atlantica	2.0			.7		.1		.1		.2
Oithona conifera										.1
Oncae venustra					.1				.1	
DECAPODA										
Sergestes sp.	.3									
EUPHAUSIACEA										
Meganyctiphanes norvegica	.5	16.8	.6	.1	.5			.1		
Meganyctiphanes sp.							.1			
Nematoscelis megalops	.1		.1	.1	.2	.1			.1	.1
Thysanoessa longicaudata			8.0	6.0	4.0	3.1	1.3	1.2		.5
Thysanoessa sp. zoea			.3							
Thysanopoda acutifrons								.1		
Unidentified	2.0	1.0	6.0	8.0	4.0	2.0	.6	.3		.3

Table 2(continued)

TOW 3

SAMPLE	1	2	3	4.	5	6	7	8	9	10
GASTROPODA										
Clione sp.	2.0				.8	5.0	2.0	.7		.4
Limacina retroversa	26.0		1.0			.1				.1
Paedoclione dolioformis							.1			
HYDROZOA										
Agalma elegans									.1	
Dimophyes arctica									.1	
Stephanoma									.1	
MOLLUSCA										
Squid			.004							
OSTEICHTHYES										
Myctophidae	.03	.12	.07	.004	.02	.01			.03	
Nemichthyes scolopaceus							.003			
OSTRACODA										
Conchoecia sp.									.1	
Conchoecia acuticosta						.1		.1		.2
Conchoecia elegans							.1		.2	
Conchoecia obtusata									.1	
TOTAL BIOMASS (g/M^3)	1.154	1.935	.476	.213	.252	.156	.107	.070	.077	.063
MYCTOPHIDAE (g/M^3)	.01	.05	.05	.002	.01	.002			.002	
EUPHAUSIACEA (g/M^3)	.081	.571	.091	.011	.012	.116	.003	-	.005	.045
COPEPODA ($\#/M^3$)	1122.0	1645.0	172.0	55.0	39.1	27.1	15.2	18.1	27.0	25.2

Table 3 Size range of micronekton collected on the edge of the Nova Scotia Shelf in 1977.

Species	LENGTH MEASUREMENTS (MM) Range (mm)	Mean ± standard deviation
OSTEICHTHYES		
Unidentified species	2 - 13	7.82 ± 2.02
Sebastes marinus	6 - 12	8.83 ± 1.52
Merluccius bilinearis	5 - 10	7.50 ± 1.51
Benthosema glaciale	23 - 60	40.41 ± 11.09
Benthosema suborbitale	14 - 15	14.63 ± 0.88
Bolinichthys indicus	21 - 23	21.33 ± 1.04
Ceratoscopelus maderensis	63 - 69	66.00 ± 3.12
Diogenichthys atlanticus	18*	
Lampanyctus alatus	18 - 31	26.00 ± 5.60
Notolychnus valdiviae	14	
CEPHALOPODA		
Squid	7 - 44	15.72 ± 7.37
Octopus	45*	
EUPHAUSIACEA**		
Meganyctiphanes norvegica	13 - 35	23.86 ± 5.13
Nematoscelis megalops	12 - 24	17.17 ± 3.37
DECAPODA**		
Sergestes sp.	10 - 31	17.55 ± 5.49
GASTROPODA		
Pteropoda	5 - 23	10.77 ± 5.04
POLYCHAETA		
Tomopteris sp.	4 - 11	6.61 ± 2.15
AMPHIPODA		
Hyperiidae	2 - 18	6.00 ± 3.29

* Only one individual

** Individuals less than 1cm not included